H.R. 4715—TECHNOLOGY CORPORATION OF AMERICA

HEARING

BEFORE THE

SUBCOMMITTEE ON
SCIENCE, RESEARCH AND TECHNOLOGY

OF THE

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SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

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CONTENTS

WITNESSES

Page

September 12, 1990:
  Hon. Mel Levine, a Representative in Congress from the State of California 10
  Hon. Don Ritter, a Representative in Congress from the Commonwealth of Pennsylvania 18
  Ira C. Magaziner, President, SJS, Inc., Providence, Rhode Island; Richard J. Elkus, Jr., Chairman, Prometrix Corp., Santa Clara, California; Thomas H. Stanton, Olwine, Connelly, Chase, O'Donnell & Weyher, Washington, DC; Robert L. Stern, Consultant in Technology Management, Washington, DC 37

APPENDIX

Origins of RCA, by Richard J. Solomon, MIT Media Lab 85
H.R. 4715, introduced by Hon. Mel Levine (D-CA) 87
The Need For A Civilian ARPA by Dr. Burton I. Edelson 100

H.R. 4715—TECHNOLOGY CORPORATION OF AMERICA

WEDNESDAY, SEPTEMBER 12, 1990

House of Representatives,
Committee on Science, Space, and Technology,
Subcommittee on Science, Research and Technology,
Washington, D.C.

The subcommittee met, pursuant to call, at 2:09 p.m., in Room 2318, Rayburn House Office Building, Hon. Tim Valentine [chairman of the subcommittee], presiding.

Mr. Valentine. If I could have your attention, folks, we will try to get started with this hearing. I hear footsteps. I think that's Mr. Ritter. Our colleague is on the way.

Just after World War I, a group of Americans led by Assistant Secretary of the Navy Franklin D. Roosevelt came together to develop a strategy to capture the lead in a critical new communications technology which at the time was dominated by the British. Assistant Secretary Roosevelt developed a plan for the Navy to award contracts to a new corporation which would buy up patents and capture a share of this promising market for United States industry. The new technology was radio, and the new corporation was Radio Corporation of America (RCA).

In those days, radio's only application was as a means to communicate between ships at sea and from ship to shore. RCA began as a consortium to pool American-held patents in radio technology, and the Navy was one of its original stockholders. The new corporation bought out British holders in Marconi Wireless Telegraph Company of America, drew on General Electric—that is, GE's—expertise in electric alternators for radio transmission, and built on American Telephone and Telegraph's—that is, AT&T's—experiments using the vacuum tube.

RCA stock was more or less evenly distributed among the Department of the Navy and four corporations—Westinghouse, GE, AT&T, and United Fruit. United Fruit, incidentally, was a corporation which depended upon radio communications to control its merchant marine fleet. David Sarnoff was hired as general manager, and the company was up and running. After a few years, the Navy sold its shares in RCA, which went on to become an immensely successful corporate giant, as we all know.

It is hard to imagine what 20th century life would be like without radio and without radio technology. It's just as hard for us to imagine what life in the United States would be like if our Government and a few critical corporations had not made that early decision to fight for a share of that new technology for this country.

The history of RCA teaches us one vital lesson, and that is that our Government can play a successful role in nurturing critical new technologies. We hear over and over again that the Federal Government makes a mess when it supports the development of specific technologies, that only the marketplace can make these decisions. But what of that which resulted in RCA?

If the Navy at Franklin Roosevelt's instigation had not acted as a catalyst to form RCA, could the United States have become the world leader in radio technology, as well as a host of related technologies such as sound movies, television, long distance sound transmissions, and communications networks?

The framers of H.R. 4715, the Technology Corporation of America Act of 1990, believe that we cannot afford to forget the lessons of RCA's formation, especially when other governments actively participate in the launching of their own domestic high tech industries. H.R. 4715 establishes a government-chartered, industry-run non-profit corporation which would seek to replicate RCA's early success.

Today, the risks of pioneering a new technology are higher than ever for U.S. corporations, where stockholders demand short-term profitability and low-cost patient capital to finance innovation that is hard to come by.

Can the Federal Government make a significant contribution to industry's own efforts to recapture market share in critical high technologies? This committee's answer has been yes. The Advanced Technology Program in the Department of Commerce will play a key role in fostering the development of critical new U.S. technology ventures. We are committed to nurturing this new program through its early years. But this is not enough. Other elements of a comprehensive policy need to be considered if this country is to maintain its technology pre-eminence.

A Technology Corporation of America might be one such innovative approach to both choosing and financing strategic new technologies.

[The prepared opening statement of Mr. Valentine follows:]

OPENING STATEMENT OF THE
HONORABLE TIM VALENTINE (D-NC)
HEARING ON
H.R. 4715, THE TECHNOLOGY CORPORATION OF AMERICA ACT OF 1990

SEPTEMBER 12, 1990

JUST AFTER WORLD WAR I A GROUP OF AMERICANS, LED BY ASSISTANT SECRETARY OF THE NAVY, FRANKLIN D. ROOSEVELT, CAME TOGETHER TO DEVELOP A STRATEGY TO CAPTURE THE LEAD IN A CRITICAL NEW COMMUNICATIONS TECHNOLOGY WHICH AT THE TIME WAS DOMINATED BY THE BRITISH. ASSISTANT SECRETARY ROOSEVELT DEVELOPED A PLAN FOR THE NAVY TO AWARD CONTRACTS TO A

NEW CORPORATION WHICH WOULD BUY UP PATENTS AND CAPTURE A SHARE OF THIS PROMISING MARKET FOR UNITED STATES INDUSTRY.

THE NEW TECHNOLOGY WAS RADIO; AND THE NEW CORPORATION WAS THE RADIO CORPORATION OF AMERICA -- RCA.

IN THOSE DAYS RADIO'S ONLY APPLICATION WAS AS A MEANS TO COMMUNICATE BETWEEN SHIPS AT SEA AND FROM SHIP TO SHORE. RCA BEGAN AS A CONSORTIUM TO POOL AMERICAN-HELD PATENTS IN RADIO TECHNOLOGY, AND THE NAVY WAS ONE OF ITS ORIGINAL STOCKHOLDERS. THE NEW CORPORATION BOUGHT OUT BRITISH HOLDINGS IN MARCONI WIRELESS TELEGRAPH COMPANY OF AMERICA, DREW

ON GENERAL ELECTRIC'S (GE) EXPERTISE IN ELECTRIC ALTERNATORS FOR RADIO TRANSMISSION, AND BUILT ON AMERICAN TELEPHONE AND TELEGRAPH'S (AT&T) EXPERIMENTS USING VACUUM TUBES.

RCA STOCK WAS MORE OR LESS EVENLY DISTRIBUTED AMONG THE DEPARTMENT OF THE NAVY AND FOUR CORPORATIONS -- WESTINGHOUSE, GE, AT&T, AND UNITED FRUIT (WHICH DEPENDED UPON RADIO COMMUNICATIONS TO CONTROL ITS MERCHANT MARINE FLEET). DAVID SARNOFF WAS HIRED AS GENERAL MANAGER, AND THE COMPANY WAS UP AND RUNNING. AFTER A FEW YEARS THE NAVY SOLD ITS SHARES IN RCA, WHICH WENT ON TO BECOME AN IMMENSELY SUCCESSFUL CORPORATE GIANT.

IT IS HARD TO IMAGINE WHAT TWENTIETH CENTURY LIFE WOULD BE LIKE WITHOUT RADIO TECHNOLOGY. AND IT IS JUST AS HARD FOR US TO IMAGINE WHAT LIFE IN THE UNITED STATES WOULD BE LIKE IF OUR GOVERNMENT AND A FEW CRITICAL CORPORATIONS HAD NOT MADE THAT EARLY DECISION TO FIGHT FOR A SHARE OF THAT NEW TECHNOLOGY FOR OUR COUNTRY. THE HISTORY OF RCA TEACHES US ONE VITAL LESSON: THAT OUR GOVERNMENT CAN PLAY A SUCCESSFUL ROLE IN NURTURING CRITICAL NEW TECHNOLOGIES.

WE HEAR OVER AND OVER AGAIN THAT THE FEDERAL GOVERNMENT MAKES A MESS WHEN IT SUPPORTS THE DEVELOPMENT OF SPECIFIC TECHNOLOGIES. ONLY THE MARKETPLACE CAN MAKE THOSE DECISIONS. BUT

WHAT OF RCA? IF THE NAVY, AT FRANKLIN ROOSEVELT'S INSTIGATION, HAD NOT ACTED AS A CATALYST TO FORM RCA, COULD THE UNITED STATES HAVE BECOME THE WORLD LEADER IN RADIO TECHNOLOGY, AS WELL AS A HOST OF RELATED TECHNOLOGIES SUCH AS SOUND MOVIES, TELEVISION, LONG DISTANCE SOUND TRANSMISSIONS, AND COMMUNICATION NETWORKS?

THE FRAMERS OF H.R. 4715, THE TECHNOLOGY CORPORATION OF AMERICA ACT OF 1990, BELIEVE THAT WE CANNOT AFFORD TO FORGET THE LESSONS OF RCA'S FORMATION ESPECIALLY WHEN OTHER GOVERNMENTS ACTIVELY PARTICIPATE IN THE LAUNCHING OF THEIR DOMESTIC HIGH TECH INDUSTRIES. H.R. 4715 ESTABLISHES A GOVERNMENT-

CHARTERED, INDUSTRY-RUN NONPROFIT CORPORATION WHICH WOULD SEEK TO REPLICATE RCA'S EARLY SUCCESS.

TODAY, THE RISKS OF PIONEERING A NEW TECHNOLOGY ARE HIGHER THAN EVER FOR U.S. CORPORATIONS. STOCKHOLDERS DEMAND SHORT-TERM PROFITABILITY, AND LOW-COST PATIENT CAPITAL TO FINANCE INNOVATION IS HARD TO FIND.

CAN THE FEDERAL GOVERNMENT MAKE A SIGNIFICANT CONTRIBUTION TO INDUSTRY'S OWN EFFORTS TO RECAPTURE MARKET SHARE IN CRITICAL HIGH TECHNOLOGIES? THIS COMMITTEE'S ANSWER HAS BEEN: YES. THE ADVANCED TECHNOLOGY PROGRAM IN THE DEPARTMENT OF COMMERCE WILL PLAY A KEY

ROLE IN FOSTERING THE DEVELOPMENT OF CRITICAL NEW U.S. TECHNOLOGY VENTURES. WE ARE COMMITTED TO NURTURING THIS NEW PROGRAM THROUGH ITS EARLY YEARS.

BUT THIS IS NOT ENOUGH. OTHER ELEMENTS OF A COMPREHENSIVE POLICY NEED TO BE CONSIDERED IF THIS COUNTRY IS TO MAINTAIN ITS TECHNOLOGY PREEMINENCE. A TECHNOLOGY CORPORATION OF AMERICA MIGHT BE ONE SUCH INNOVATIVE APPROACH TO BOTH CHOOSING AND FINANCING STRATEGIC NEW TECHNOLOGIES. IN OUR HEARING TODAY, WE WILL EXAMINE HOW THIS CONCEPT CAN COMPLEMENT AND ENHANCE OUR NATION'S EFFORTS TO FOSTER INNOVATION.

In our hearing today we will examine how this concept can complement and enhance our Nation's efforts to foster innovation, and we are happy to have two of the prime movers behind this legislation, two of the more outstanding, innovative and aggressive Members of Congress. I have said that, I think, just like you wrote it for me.

[Laughter.]

Mr. VALENTINE. Seriously, two outstanding individuals here to testify—

Mr. RITTER. We will pay you later, Mr. Chairman.

Mr. VALENTINE. Cash—about their offspring, which I'm happy to say that I have cosponsored with many others.

I will recognize first, because his name first appears on the sheet before me, Representative Mel Levine of California, who will be followed by our other colleague, Representative Don Ritter of Pennsylvania

Congressman Levine.

STATEMENT OF THE HONORABLE MEL LEVINE, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Mr. LEVINE. Mr. Chairman, thank you very much, not only for those kind remarks that you did read as written, but also and more significantly for the very important and strong and consistent leadership that you have given in so many of these areas. I very much appreciate your holding these hearings, your cosponsorship of this legislation, and your leadership in this area which is so critical to the country.

Mr. Chairman, as you know, the United States is at an important turning point in its history. Today, our living standards and status as a great power could be adversely affected by the loss of our technological leadership.

The United States, as you indicated in your opening remarks, was last challenged this way by the British invention of the radar in the early 1920s. At that time private sector companies joined together to form the Radio Corporation of America, which subsequently became one of America's leading technological efforts. Today, there is a similar need for private sector innovation and cooperation which should be encouraged by the public sector.

I know that this subcommittee does not need to be convinced of the severity of the economic challenges facing the United States. A brief look at the two most critical challenges we face illuminates the urgent need for a Technology Corporation of America.

For starters, Mr. Chairman, American firms uniformly report that they are hard-pressed to compete with the cash reserves enjoyed by giant foreign competitors. Many of these competitors have access to far more patient and far more low-cost capital than do our own firms. As a result, the Commerce Department reports even leading-edge U.S. industries like electronics now stand in danger of being surpassed by our trading partners, particularly our trading partners across the Pacific.

And even more ominously, Commerce also finds that the Japanese are now leading or are even with us in most of the emerging technologies of the 1990s. Many of these trends may affect the strength of America's industrial base.

As the recent cover story for the Harvard Business Review by M.I.T.'s Charles Ferguson warned about the U.S. information technology industry, and I quote: "If U.S. companies continue business as usual, they will either fail outright or become, in effect, local design and marketing subsidiaries of Japanese companies that will dominate a $1 trillion hardware industry."

In a closed meeting, the president of one of America's most successful computer companies told me that he lay awake at night worrying that even his company was in serious danger of being snuffed out by his foreign competitors within the next 5 years. The problem appears to be particularly serious America's entrepreneurial sector. Certainly many entrepreneurial firms can attract venture capital. They are often hard-pressed to find domestic capital that is necessary to develop full-blown industries from their new product innovations.

As a result, Mr. Chairman, an increasing number of America's technology startups find themselves facing two risks: being bought out by foreign companies or failing to fully develop their critical technologies.

But capital is only one side of the equation. In today's ferocious global economy, with our competitors systematically targeting our key industries, strategic cooperation also plays a critical role. As our own Commerce Department recently warned about the $200 billion U.S. electronics industry, and I quote: "U.S. leadership in electronics is under serious challenge and may very well be eclipsed unless there is a higher degree of consensus within industry and improved coordination with academia, Federal, State and local governments." Smaller firms in particular face other difficulties, such as a vertical integration and a lack of antitrust restrictions overseas.

To date, the most significant U.S. response to the slip in our technological leadership has been—and I strongly salute this subcommittee for its leadership in this—the creation of the innovative Advanced Technology Program at NIST. The overwhelming bipartisan support of ATP by this committee indicates that there is a broad committee consensus on two very important key points: first, the nature of the technological challenges facing America, and second, on the appropriateness of using limited Federal funds to meet those challenges.

Some have seen, however, that there may be a need for a private sector counterpart to the very important public sector initiative that this subcommittee spearheaded last year, or earlier this year, in the development of ATP. Such an entity should be designed like TCA, as an industry-run corporation for precompetitive activities, enjoying a government charter.

A Technology Corporation of America will help preserve America's entrepreneurial strength while providing initial government support where necessary. TCA grew out of that call to redirect the United States' Federal R&D priorities to better meet the market-oriented needs of our domestic industries, a call that I want to emphasize that my colleague and friend Mr. Ritter has been leading for a significant period of time.

For example, a recent estimate by the prestigious Council on Competitiveness estimated that, "At most, only about 10 percent of Federal R&D is relevant to the technical needs of industry."

Certainly we all recognize that $50 million is a tiny slice of the pie. But this small, relatively small investment in a TCA would send a very important signal to American industry, and would help to catalyze some critical cooperative ventures.

As with ATP or with Fannie Mae or with Sematech, there is a market imperfection—the myopia of short-term gains—that a TCA can help correct without taking any control away from private industry.

As stated in a white paper signed by among others the American Electronics Association, a former Under Secretary of Defense, and the late distinguished Bob Noyce, "An increasing number of U.S. industries will be forced to develop cooperative enterprises in the 1990s to survive foreign targeting."

Besides brokering lower cost capital for U.S. firms, the TCA could also serve such potential roles as supporting private sector initiated consortia and encouraging cooperative ventures between industry, government, and academia; devising means to counter the lack of foreign antitrust restrictions; promoting direct buying strategies for new products by Federal agencies; recommending new Federal Government policies to revitalize the U.S. industrial base; and devising ways to respond to advantages of vertical integration enjoyed by foreign firms.

For example, TCA could have played an important role in jumpstarting U.S. memories. From my discussions with individuals involved in the effort, an independent, prestigious council of industry leaders could have pushed the players closer to an agreement. It would also have been better able to represent the national economic interest in the negotiations without spending a penny of government funds.

As I said at the outset, Mr. Chairman, it's my belief that this subcommittee is already persuaded as to the seriousness of the challenges facing us, and I'm sure many would agree that the purposes of TCA, as outlined above, are top high-tech priorities for the United States.

So the key question in that case I think becomes: Is an organization like TCA the best way to accomplish those broad goals the subcommittee has already embraced? I, and the bipartisan group of members supporting the legislation, believe that it is. TCA can and will work, and this hearing is an excellent opportunity to explore the best ways to streamline and improve the design of the TCA concept.

First, TCA will be run by industry to meet market-oriented needs. TCA is an experiment in industry-government cooperation that relies more than ever on industry expertise, and it uses that experience and a small amount of funds to leverage that wisdom.

Second, TCA will have the oversight and safeguards necessary to prevent anything like another Synfuels from being the result. And, if this subcommittee wants to place tighter controls to further guarantee its integrity, we should move in that direction.

Third, the Federal Government will never put up more than 49 percent for any cooperative venture. This ensures that industry will always be putting their resources on the line. Nobody wants to risk their own money on a dog, and nobody will be asked to. The public will not be asked to risk any money that is as great or greater than that the private sector will be asked to risk.

And fourth, we've got the framework for a structure that can get the job done. This hearing, I believe, will help supporters of TCA find ways to strengthen that structure, making it most responsive to America's long-term high tech needs. With its independent, nonpartisan design it can stand outside congressional/administration high tech debates and prove to be a reliable, permanent source of expertise.

I am looking forward to the testimony that we will hear today from those that you've invited, Mr. Chairman, and want to again thank you and the subcommittee for your leadership and your interest in this legislation. And I also want to thank my colleague and friend, Mr. Ritter, who is the principal cosponsor of this legislation and who I take it will be the next witness.

[The prepared statement of Mr. Levine follows:]

TESTIMONY ON THE TECHNOLOGY CORPORATION OF AMERICA
BY REP. MEL LEVINE (D-CA)
BEFORE THE SCIENCE, RESEARCH & TECHNOLOGY SUBCOMMITTEE
SEPTEMBER 12, 1990

I WANT TO THANK THE COMMITTEE FOR HOLDING THESE HEARINGS.

THE UNITED STATES IS AT AN IMPORTANT TURNING-POINT IN ITS HISTORY. TODAY, OUR LIVING STANDARDS AND STATUS AS A GREAT POWER COULD BE ADVERSELY AFFECTED BY THE LOSS OF OUR TECHNOLOGICAL LEADERSHIP.

THE U.S. WAS LAST CHALLENGED THIS WAY BY THE BRITISH INVENTION OF THE RADAR IN THE EARLY 1920'S. PRIVATE SECTOR COMPANIES JOINED TOGETHER TO FORM THE RADIO CORPORATION OF AMERICA, WHICH BECOME ONE OF OUR LEADING TECHNOLOGICAL EFFORTS.

TODAY THERE IS A SIMILAR NEED FOR PRIVATE SECTOR INNOVATION AND COOPERATION, WHICH SHOULD BE ENCOURAGED BY THE PUBLIC SECTOR.

I KNOW THAT THIS SUBCOMMITTEE DOES NOT NEED TO BE CONVINCED OF THE SEVERITY OF THE ECONOMIC CHALLENGES FACING THE U.S.

A BRIEF LOOK AT THE TWO MOST CRITICAL CHALLENGES WE FACE ILLUMINATES THE URGENT NEED FOR A TCA.

FOR STARTERS, AMERICAN FIRMS UNIFORMLY REPORT THAT THEY ARE HARD-PRESSED TO COMPETE WITH THE CASH RESERVES ENJOYED BY GIANT FOREIGN COMPETITORS. MANY OF THESE COMPETITORS HAVE ACCESS TO FAR MORE PATIENT AND LOW-COST CAPITAL.

AS A RESULT, THE COMMERCE DEPARTMENT REPORTS, THAT EVEN LEADING-EDGE U.S. INDUSTRIES LIKE ELECTRONICS NOW STAND IN DANGER OF BEING SURPASSED BY THE JAPANESE.

AND EVEN MORE OMINOUSLY, COMMERCE ALSO FINDS THAT THE JAPANESE ARE NOW LEADING OR ARE EVEN WITH US IN MOST OF THE EMERGING TECHNOLOGIES OF THE 1990'S. MANY OF THESE TRENDS MAY AFFECT THE STRENGTH OF OUR INDUSTRIAL BASE.

AS THE RECENT COVER STORY FOR THE HARVARD BUSINESS REVIEW BY MIT'S CHARLES FERGUSON WARNED ABOUT THE U.S. INFORMATION TECHNOLOGY INDUSTRY:

> "IF U.S. COMPANIES CONTINUE BUSINESS AS USUAL, THEY WILL EITHER FAIL OUTRIGHT OR BECOME, IN EFFECT, LOCAL DESIGN AND MARKETING SUBSIDIARIES OF JAPANESE COMPANIES THAT WILL DOMINATE A $1 TRILLION HARDWARE INDUSTRY."

IN A CLOSED MEETING, THE PRESIDENT OF ONE OF THESE COMPUTER COMPANIES -- ONE OF THE FASTEST GROWING U.S. FIRMS -- EXPRESSED HIS WORRIES TO ME. HE TOLD ME THAT HE LAY AWAKE AT NIGHT WORRYING THAT EVEN HIS TREMENDOUSLY SUCCESSFUL COMPANY WAS IN SERIOUS DANGER OF BEING SNUFFED OUT BY HIS FOREIGN COMPETITORS IN FIVE YEARS.

THE PROBLEM APPEARS TO BE PARTICULARLY SERIOUS FOR AMERICA'S ENTREPRENEURIAL SECTOR. CERTAINLY MANY ENTREPRENEURIAL FIRMS CAN ATTRACT VENTURE CAPTIAL.

BUT THEY ARE OFTEN HARD-PRESSED TO FIND THE DOMESTIC CAPITAL NEEDED TO DEVELOP FULL-BLOWN INDUSTRIES FROM THEIR NEW PRODUCT INNOVATIONS.

AS A RESULT, AN INCREASING NUMBER OF AMERICA'S TECHNOLOGY STARTUPS FIND THEMSELVES FACING TWO RISKS: BEING BOUGHT OUT BY FOREIGN COMPANIES, OR FAILING TO FULLY DEVELOP THEIR CRITICAL TECHNOLOGIES.

BUT CAPITAL IS ONLY ONE SIDE OF THE EQUATION.

IN TODAY'S FEROCIOUS GLOBAL ECONOMY -- WITH OUR COMPETITORS SYSTEMATICALLY TARGETING OUR KEY INDUSTRIES -- STRATEGIC COOPERATION ALSO PLAYS A CRITICAL ROLE.

AS OUR OWN COMMERCE DEPT. RECENTLY WARNED ABOUT THE $200 BILLION U.S. ELECTRONICS INDUSTRY:

"U.S. LEADERSHIP IN ELECTONICS IS UNDER SERIOUS CHALLENGE AND MAY VERY WELL BE ECLIPSED UNLESS (THERE IS) A HIGHER DEGREE OF CONSENSUS WITHIN INDUSTRY AND IMPROVED COORDINATION WITH ACADEMIA, FEDERAL, STATE AND LOCAL GOVERNMENTS."

SMALLER FIRMS IN PARTICULAR FACE OTHER DIFFICULTIES, SUCH AS A VERTICAL INTEGRATION AND A LACK OF ANTI-TRUST RESTRICTIONS OVERSEAS.

TO DATE, THE MOST SIGNFICANT U.S. RESPONSE TO THE SLIP IN OUR TECHNOLOGICAL LEADERSHIP HAS BEEN THE CREATION OF THE INNOVATIVE ADVANCED TECHNOLOGY PROGRAM AT NIST.

THE OVERWHELMING, BIPARTISAN SUPPORT OF ATP BY THIS COMMITTEE INDICATES THAT THERE IS A BROAD COMMITTEE CONSENSUS ON TWO KEY POINTS.

FIRST, THE NATURE OF THE TECHNOLOGICAL CHALLENGES FACING AMERICA.

AND SECOND, ON THE APPROPRIATENESS OF USING LIMITED FEDERAL FUNDS TO MEET THOSE CHALLENGES.

SOME HAVE SEEN, HOWEVER, THAT THERE MAY BE A NEED FOR A PRIVATE SECTOR COUNTERPART TO THE ATP.

SUCH AN ENTITY SHOULD BE DESIGNED LIKE THE TCA, AS AN INDUSTRY-RUN CORPORATION FOR PRE-COMPETITIVE ACTIVITIES, ENJOYING A GOVERNMENT CHARTER.

A TCA WILL HELP PRESERVE AMERICA'S ENTREPRENEURIAL STRENGTH WHILE PROVIDING INITIAL GOVERNMENT SUPPORT WHERE NECESSARY.

TCA GREW OUT OF THAT CALL TO REDIRECT THE U.S.'S FEDERAL R&D PRIORITIES TO BETTER MEET THE MARKET-ORIENTED NEEDS OF OUR DOMESTIC INDUSTRIES.

FOR EXAMPLE, A RECENT ESTIMATE BY THE PRESTIGIOUS COUNCIL ON COMPETITIVENESS ESTIMATED THAT:

"AT MOST, ONLY ABOUT 10% OF FEDERAL R&D IS RELEVANT TO THE TECHNICAL NEEDS OF INDUSTRY."

CERTAINLY WE ALL RECOGNIZE THAT FIFTY MILLION DOLLARS IS A TINY SLICE OF THE PIE. BUT THIS SMALL INVESTMENT IN A TCA WOULD SEND AN IMPORTANT SIGNAL TO AMERICAN INDUSTRY AND HELP TO CATALYZE SOME CRITICAL COOPERATIVE VENTURES.

AS WITH ATP OR FANNIE MAE OR SEMATECH, THERE IS A MARKET IMPERFECTION - THE MYOPIA OF SHORT-TERM GAINS - THAT A TCA CAN HELP CORRECT WITHOUT TAKING ANY CONTROL AWAY FROM PRIVATE INDUSTRY.

AS STATED IN A WHITE PAPER SIGNED BY AMONG OTHERS THE AMERICAN ELECTRONICS ASSOCIATION, A FORMER UNDERSECRETARY OF DEFENSE, AND THE LATE BOB NOYCE:

"AN INCREASING NUMBER OF U.S. INDUSTRIES WILL BE FORCED TO DEVELOP COOPERATIVE ENTERPRISES IN THE 1990'S TO SURVIVE FOREIGN TARGETING."

BESIDES BROKERING LOWER COST CAPITAL FOR U.S. FIRMS, THE TCA COULD ALSO SERVE SUCH POTENTIAL ROLES AS:

*SUPPORTING PRIVATE SECTOR INITIATED CONSORTIA AND ENCOURAGING COOPERATIVE VENTURES BETWEEN INDUSTRY, GOVERNMENT, AND UNIVERSITIES
*DEVISING WAYS TO COUNTER THE LACK OF FOREIGN ANTI-TRUST RESTRICTIONS
*PROMOTING DIRECT BUYING STRATEGIES FOR NEW PRODUCTS BY FEDERAL AGENCIES
*RECOMMENDING NEW FEDERAL GOVERNMENT POLICIES TO REVITALIZE THE U.S. INDUSTRIAL BASE
*AND DEVISING WAYS TO RESPOND TO ADVANTAGES OF VERTICAL INTEGRATION ENJOYED BY FOREIGN FIRMS.

FOR EXAMPLE, TCA COULD HAVE PLAYED AN IMPORTANT ROLE IN U.S. MEMORIES.

FROM MY DISCUSSIONS WITH INDIVIDUALS INVOLVED IN THE EFFORT, AN INDEPENDENT, PRESTIGIOUS COUNCIL OF INDUSTRY LEADERS COULD HAVE PUSHED THE PLAYERS CLOSER TO AN AGREEMENT.

IT WOULD ALSO HAVE BEEN BETTER ABLE TO REPRESENT THE NATIONAL ECONOMIC INTEREST IN THE NEGOTIATIONS, WITHOUT CONTRIBUTING A PENNY OF GOVERNMENT FUNDS.

AS I SAID AT THE OUTSET, IT'S MY BELIEF THAT THIS SUBCOMITTEE IS ALREADY PERSUADED AS TO THE SERIOUSNESS OF THE CHALLENGES FACING US.

AND I'M SURE MANY WOULD AGREE THAT THE PURPOSES OF TCA, AS OUTLINED ABOVE, ARE TOP HI-TECH PRIORITIES FOR THE U.S.

SO THE KEY QUESTION FOR THIS HEARING BECOMES: IS AN ORGANIZATION LIKE TCA THE BEST WAY TO ACCOMPLISH THOSE BROAD GOALS?

I, AND THE BIPARTISAN GROUP OF MEMBERS SUPPORTING THE LEGISLATION, BELIEVE THAT IT IS. TCA CAN AND WILL WORK, AND THIS HEARING IS AN EXCELLENT OPPORTUNITY TO EXPLORE THE BEST WAYS TO STEAMLINE AND IMPROVE THE DESIGN OF THE TCA CONCEPT.

FIRST, IT WILL BE RUN BY INDUSTRY TO BEST MEET MARKET-ORIENTED NEEDS.

TCA IS AN EXPERIMENT IN INDUSTRY-GOVERMENT COOPERATION THAT RELIES MORE THAN EVER ON INDUSTRY EXPERTISE.

SECOND, IT HAS THE OVERSIGHT AND SAFEGUARDS NECESSARY TO PREVENT ANOTHER SYNFUELS. AND IF THIS SUBCOMMITTEE WANTS TO PLACE TIGHTER CONTROLS TO FURTHER GUARANTEE ITS INTEGRITY, WE SHOULD MOVE IN THAT DIRECTION.

THIRD, THE FEDERAL GOVERNMENT WILL NEVER PUT UP MORE THAN 49% OF ANY COOPERATIVE VENTURE. THIS ENSURES THAT INDUSTRY WILL ALWAYS BE PUTTING THEIR OWN RESOURCES ON THE LINE.

NOBODY WANTS TO RISK THEIR OWN MONEY ON A DOG.

AND FOURTH, WE'VE GOT THE FRAMEWORK OF A STRUCTURE THAT CAN GET THE JOB DONE. THIS HEARING WILL HELP SUPPORTERS OF TCA FIND WAYS TO STRENGTHEN THAT STRUCTURE, MAKING IT MOST RESPONSIVE TO AMERICA'S LONG-TERM HI-TECH NEEDS.

WITH ITS INDEPENDENT, NON-PARTISAN DESIGN IT CAN STAND OUTSIDE CONGRESSIONAL-ADMINISTRATION HI-TECH DEBATES AND PROVE A RELIABLE, PERMANENT SOURCE OF EXPERTISE.

I LOOK FORWARD TO THE TESTIMONY WE WILL HEAR TODAY, AND THANK THE COMMITTEE AGAIN FOR ITS INTEREST IN THIS LEGISLATION.

Mr. **Valentine**. Mr. Ritter?

STATEMENT OF THE HONORABLE DON RITTER, A REPRESENTATIVE IN CONGRESS FROM THE COMMONWEALTH OF PENNSYLVANIA

Mr. **Ritter**. Thank you, Mr. Chairman. And I just want to commend my colleague on his excellent testimony. If there was anything in there that I disagreed with, I either was inattentive to it or something else. But it was excellent testimony. Thank you, Mel.

Mr. Chairman, I want to thank you for calling this important hearing and giving me the opportunity to appear before the subcommittee. The subcommittee has a very important role. Your leadership in this crucial area of America's global competitiveness is proven. It's essential. It's going to be more and more important with every passing month.

There are economic forces evolving throughout the world that will determine the jobs, the industries, and the role that America plays in the next century, and, as I see it, we have a choice to make. We can either stand by and let others decide our fate, or we can make some decisions and take actions needed that better allow us to determine our own destiny. I prefer the latter.

The bill comes before us at a critical time. There is the emergence of democracy and freer markets and economies in Eastern Europe, and this holds promise for eventually improving our trade position in high technology products and processes. The crisis in the Persian Gulf makes it imperative that American business work even harder to compete and be even more productive, given the increasing cost of energy.

We still face concerted efforts by our competitors, including Japan, the "New Japans" in Asia, and the European Community, to increase their share of the rich American and global marketplace for high technology goods and services.

We are losing market share in a wide variety of product areas in leading high tech industries at an alarming rate. Our ad hoc approach toward industry is in contrast to foreign governments and collaboration between industry, and it is placing us at a competitive disadvantage.

In the most critical fields of high technology, such as artificial intelligence and the high performing—high performance computing, there is not one single area where we are gaining on the Japanese. Indeed, there are many where we are still ahead. We are behind in a large number, but there are some where we're still ahead. But we're losing ground in each and every one of them, such as biotechnology, advanced materials, superconductors, digital-imaging technology, and the list goes on and on.

If we don't act, we eventually yield our leadership position in these critical technologies, as we've done with autos, VCRs, compact discs, semiconductors, machine tools, TV, and that list goes on and on. Limited Federal investments can create high leverage if they are made in partnership with industry. That is what the TCA is all about. Indeed, the leverage could be ever greater if the efforts are led to a greater extent by industry.

There is a big difference between making computer chips or potato chips, and the time has come for America to take a leap forward in the development and manufacture of technology-intensive, high value-added products. We need to stimulate that segment of our economy, not just treat it like any other. We need to support the research that goes into coming up with a new idea or concept, the design and development required to determine feasibility, and the capacity to manufacture reliable, quality products here in the U.S. for the global economy elsewhere.

And that is the goal of H.R. 4715, the bill that creates the Technology Corporation of America. 4715 enjoys broad bipartisan support. Since the initial introduction, 20 additional members have signed on, which includes 6 Republicans to date. I'm pleased to have been a partner with Mr. Levine in the development of the bill, working side-by-side with my friend and colleague from California

With accelerating product cycle times, with R&D and innovation a major feature of the Quality Revolution, R&D must be done closer and closer to the customer. I would prefer to see a far greater share of U.S. R&D performed in the private sector. In Japan, 80 percent of the R&D is done in the private sector, and then government serves as a coordinator, a stimulant. But we're stuck with our present system, and we need to adapt it to today's world.

Our Federal R&D economy is driven so much by mission agency momentum of the past and the political science, let's face it, of the present. The Federal Government pays for nearly half of all the R&D performed in the U.S. each year. Yet there is no set of priorities for how the money is spent. That lack of priorities creates a vacuum in which it's too often true that politics, rather than the pressures of the marketplace, dictate how Federal R&D funds are spent. The result, as a recent Northeast-Midwest Institute report made clear, is that Federal support tends to promote research only remotely connected with commercial payoffs. TCA would, ideally, move our system a little closer to the R&D needs of the private sector and the R&D demands of global competitiveness.

The bill provides for the formation of an industry-run, government-chartered non-profit corporation for R&D and manufacturing activities in the strategic high technology sector. The bill will assist in redirecting Federal civilian research and development funds to better meet the strategic R&D needs of American domestic industries competing in the world market. It can catalyze and assist in the creation of private and public sector research, development, and manufacturing activities. It can encourage cooperative R&D projects, such as consortia with industry, government, and university participation, and help to bridge the gap between the Nation's laboratories and the marketplace. It can serve as a permanent source of strategic vision for our technological and industrial base, something that seems to be assiduously avoided in this town.

The bill is only the proverbial tip of a competitiveness iceberg. Recently, the National Advisory Committee on Semiconductors (NACS) recommended four actions to strengthen America's competitiveness: make the current R&D tax credit more effective and more long-range; reduce taxes on capital gains; increase personal savings incentives; and improve semiconductor manufacturing depreciation rules.

H.R. 4715 doesn't do all this, but it is a needed step in this very direction. It is only part of the competitiveness solution. Tom Campbell, a colleague on the committee, and I introduced a Competitiveness Package of a dozen bills this May. These bills will help maximize America's traditional strengths of innovation and entrepreneurship through provisions such as, again, restoration of the credit, long-term capital incentives, investment tax credits for manufacturing and production and process, antitrust reform, and incentives for investment in technology-based startups. I urge my colleagues to take a look at these bills and possibly support them as they make their way through the legislative process.

But here we're dealing with the role of the Federal Government, and when we're talking about TCA, we're talking about minimal dollars, $50 million. It's really an experimental amount. And, when you compare it to the billions being proposed for megaprojects such as the Superconducting Supercollider, the Space Station, and others, it is a drop in the bucket. Yet it is so much closer to the reality of our global challenge, and it could have a vast impact on struggling businesses and critical long run technology fields. A little bit of seed money goes a long way. And, if the concept is proven, this and other programs like it could be able to shift somewhat the Federal R&D economy away from its focus on its own priorities and make it a more effective—or lack of priorities, and make it a more effective reflection of the priorities of our private sector.

I point to an example: high temperature superconductivity, or HTS. HTS holds a wealth of promise for the future in such areas as advanced electronic transmission, mag-lev trains, electronic devices, and so forth. Yet American companies are struggling, trying to scratch by, as the Japanese pour hundreds of millions of dollars into high-powered consortia, coordinated, stimulated, generated by the government, even though the money is largely coming from the private sector.

The CEO of a Silicon Valley high temperature superconductivity company told me recently that $5 to $7 million in funding, which could conceivably come from a TCA, or at least a part of it, would make the difference between survival and bankruptcy. That's where we are in high temperature superconductivity. We're marginal. And repeating this scenario many times over, you begin to see the immense potential of a TCA.

It's important to point out that the TCA would be created without any new Federal funding. The whole idea behind TCA is redirection of this $70 billion pool of existing Federal R&D economy. It's time to take a chunk of these vast resources already earmarked for this Federal R&D economy and put them to work on the front lines of the private sector high technology economy.

I'd like to comment on this concern that there may be some overlap between the Advanced Technology Program and the TCA. As one of the founding fathers of the Advanced Technology Program, it seems to me that they are complementary; that the TCA would be further down the stage of process and product to the marketplace, to the industrial participant; and that TCA would end up being far more industrially led and motivated and stimulated than what ATP is. It's still a government program.

In closing, I'd like to say there is a great difference between the value added to our economy between dish towels and digital video, and I had mentioned before, potato chips and semiconductor chips, that the Federal R&D policies, they don't yet recognize. They don't set priorities. So it makes it so tough for struggling high tech firms to get the help they need. TCA takes a modest step in the right direction.

Now, Mr. Chairman, again I want to thank you and the subcommittee for the opportunity to testify. I thank my colleague from California for the opportunity to work with him on this issue. And I hope our witnesses can address some of the issues and some of the other questions that have been raised, and I welcome all of them here today and look forward to their testimony.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Ritter follows:]

Opening Statement of the Honorable Don Ritter
Subcommittee on Science, Research and Technology
Technology Corporation of America
September 12, 1990

Thank you Mr. Chairman. I commend you for calling this important hearing, and. I thank you for giving me the opportunity to appear before this subcommittee today.

There are economic forces evolving throughout the world that will determine the jobs, industries and role that America will play in the next century. As I see it, we have a choice to make: we can stand by and let others decide our fate, or we can make the decisions and take the actions needed that will allow us to determine our destiny. I prefer the latter.

This bill comes before us at a critical time. The emergence of democracy and freer markets in Eastern Europe holds promise for eventually improving our trade position in high technology. The crisis in the Persian Gulf makes it imperative for American businesses to work even harder to compete.

We still face concerted efforts by our competitors, including Japan, the "New Japans" in Asia, and the European Economic Community, to increase their share of the rich American and global marketplace.

We're losing market shares in a wide variety of product areas in leading high-tech industries. Our ad hoc approach toward industry is in contrast to foreign governments, and places us at a competitive disadvantage.

In the most critical fields of high technology, such as artificial intelligence, high-performance computing, there is not one single area where we are gaining on the Japanese. Indeed, there are many where we are ahead but losing ground badly, such as biotechnology, advanced materials, superconductors, digital imaging technology, and the list goes on.

If we do not act, we will eventually yield our leadership position in many critical technologies, as we've done with autos, VCRs, compact discs, semiconductors, machine tools, TV, and so forth. Limited federal investments can create high leverage if they are made in partnership with industry...Indeed, the leverage could be even greater if the efforts are led to a greater extent by industry.

There is a big difference between making computer chips or potato chips, and the time has come for America to take a leap forward in the development of technology-intensive, high value-added products. We need to support the research that goes into coming up with a new idea or concept, the design and development required to determine feasibility, and the capacity to manufacture reliable, quality products here in the U.S.

That is the goal of H.R. 4715, the bill which would create the "Technology Corporation of America." H.R. 4715 enjoys broad bipartisan support. Since the initial introduction of the bill, 20 additional members have signed on, which includes 6 Republicans to date. I'm pleased to have been a partner in the development of this bill, working side-by-side with my colleague from California, Mel Levine.

With accelerating product cycle times, with R&D and innovation a major feature of the Quality revolution, R&D must be done closer and closer to the customer. I would prefer to see a far greater share of U.S. R&D performed in the private sector. In Japan, 80% of R&D is done in the private sector. But we are stuck with our present system.

Our federal R&D economy is driven largely by mission agency momentum of the past, and political science of the present. The federal government pays for nearly half of all the R&D performed in the U.S. each year. Yet there is no set of priorities for how that money is spent. That lack of priorities creates a vacuum in which it's too often true that politics, rather than the pressures of the marketplace, dictate how federal R&D funds are spent. The result, as a recent Northeast-Midwest Institute report made clear, is that federal support tends to promote research only remotely connected with commercial payoffs.

TCA would ideally move our system a little closer to the R&D needs of the private sector, and the R&D demands of global competitiveness.

The bill provides for the formation of an industry-run, government-chartered, nonprofit corporation for research, development, and manufacturing activities in the strategic high technology sector. The bill will assist in redirecting federal civilian research and development funds to better meet the strategic R&D needs of America's domestic industries. TCA will:

Catalyze and assist in the creation of private and public sector research, development, and manufacturing activities focused on strategic technologies.

Encourage cooperative R&D projects, such as consortia with industry, government, and university participation, to bridge the gap between the nation's laboratories and the marketplace.

Serve as a permanent source of strategic vision for our technological and industrial base.

This bill is only the proverbial tip of the competitiveness iceberg. Recently, the National Advisory Committee on Semiconductors released a working paper titled Capital Investment in Semiconductors; The Lifeblood of the U.S. Semiconductor Industry. The NACS recommends four actions to strengthen America's competitiveness:

Make the current Research and Experimentation tax credit more effective,

Reduce taxes on Capital Gains,

Increase personal savings incentives, and

Improve semiconductor manufacturing depreciation rules.

H.R. 4715 is a needed step, but it is only part of the competitiveness solution. My colleague, Tom Campbell and I introduced a Competitiveness Package of 12 bills this May. The bills will help maximize America's traditional strengths of innovation and entrepreneurship, through provisions such as the permanent restoration of the R&D tax credit, long term capital gains incentives, investment tax credits for manufacturing, and incentives for investment in technology-based start-up companies. I urge my colleagues to support these bills as they make their way through the legislative process.

The governmental funding being proposed for TCA is relatively minimal -- $50 million per year. It's really an experimental amount. Compared to the billions being proposed for megaprojects such as the Superconducting Super Collider, the Space Station, and others, it is a drop in the bucket. Yet it can have a vast impact on struggling businesses in critical, long-run technology fields. A little bit of "seed money" can go a long way, and if the concept is proven, this and other projects like it will be able to shift the federal R&D economy and make it a more effective boost to our overall economic health.

To illustrate this, I point to one example: High Temperature Superconductivity, or "HTS." HTS holds a wealth of promise for the future, in such areas as advanced electronic transmission, mag lev trains and so forth. Yet American companies are struggling, trying to scratch by, as the Japanese pour hundreds of millions of dollars into high-powered consortia. The CEO of a Silicon Valley HTS company told me recently that $5 to 7 million in funding -- funding which could come from a TCA -- would make the difference between survival and bankruptcy. Repeat this scenario many times over, and you begin to see the immense potential of a TCA.

It's also important to point out that the TCA would be created without any new federal funding. That's because we provided that the $50 million for the TCA will be redirected from the vast $70 billion pool of existing R&D funding. It's time to take a chunk of the vast resources already earmarked for federal R&D, and put them to work on the front lines of high technology.

There is a great difference in the value added to our economy between dishtowels and digital video, between potato chips and semiconductor chips, that our federal R&D policies don't yet recognize. That makes it tough for struggling high-tech firms to get the help they need. TCA would take a modest step in the right direction.

Mr. Chairman, I again would like to thank you for this opportunity to testify. I hope our witnesses can address some of the issues and other questions. I welcome all of them here today, and I look forward to hearing their testimony.

Mr. VALENTINE. Thank you, sir.

I failed to mention for the benefit of those who wouldn't know this, but, of course, Mr. Ritter is our distinguished and esteemed colleague and member of this committee and our subcommittee. So I would invite you to stay with us, if you can. And I would like to issue an invitation to Congressman Levine to sit up here with us and to further participate in today's hearing.

Mr. LEVINE. Mr. Chairman, I'm honored by the invitation and I will accept it after a brief appearance at the Rules Committee, if that's okay. Thank you.

Mr. VALENTINE. Thank you.

Mr. RITTER. And, Mr. Chairman, I also accept it. But you are from North Carolina and the chairman of this subcommittee, you must be here. I am from Pennsylvania and a member of this subcommittee, and we have several busloads of textile and apparel workers down from my district, at Lafayette Square, and they are anxiously awaiting my presence. So I will try to get back as soon as possible to participate.

Mr. VALENTINE. I, the chair—

Mr. RITTER. I'll certainly look at the testimony closely.

Mr. VALENTINE. The chair authorizes you to be absent from this meeting for that purpose.

[Laughter.]

Mr. RITTER. Thank you, Mr. Chairman.

Mr. VALENTINE. I recognize our colleague, Representative Schneider.

Ms. SCHNEIDER. Thank you very much, Mr. Chairman. I have no questions of my colleagues, seeing as how I was one of the original cosponsors of this legislation along with them. But, if I might take this opportunity to introduce my opening statement in its entirety, I would appreciate that. And only add, ad hoc, that based on the comments that our colleagues have already made to us today it's very clear that the American industry faces many economic challenges.

And I think that the President last night in his speech not only talked about our military challenges but clearly our economic challenges as we face the budget deficit crunch that we're currently facing. But included in that, he was so good as to be specific on some recommendations that some of us have been working on for a long time, such as a permanent R&D tax credit, such as increasing the savings and investment opportunities.

And needless to say, during the past decade as we look at these challenges we realize that our trade deficit has gone in 10 short years from $36 billion down to last year it was $109 billion. So, when we see the rising trade deficit, we have to recognize that it is a concern for all Americans no matter what part of the country they are from. In my own State of Rhode Island, we have about 12 percent of our employment force dependent on exports.

But, I hope that my two colleagues will join me tomorrow in the Competitiveness Caucus meeting that we will be having because we will be looking at the American auto industry, and we have finally been able to get the Big Three to agree to come to discuss with us what impact the foreign trade deficit in American autos has on the entire U.S. economy. Now, when you couple foreign auto imports and foreign oil imports, that is more than half of our trade deficit. So that if we are serious about addressing this problem, then clearly we must tackle some of those key industries. And, needless to say, the legislation we are discussing today will clearly have an impact on determining where our R&D should go.

One other point I wanted to emphasize that is very relevant to this is the whole high cost of capital for investment and how that is tying our hands. The Federal Reserve Quarterly Review just recently was estimating that the cost of capital was 2 to 3 times higher for the United States than it was for West Germany or for Japan, and I think that that should certainly get us up off of our seats and determine that we ought to be making some significant moves in that area.

When you include with the cost of capital the procurement and the tax laws, these are oftentimes determining factors that decide whether or not certain private sector technology development ventures go forward or they just die on the vine. So, needless to say, we need to examine what the appropriate role is of the Federal Government in enhancing technological advancements of private industry in the United States, and I think that that legislation takes us a major stride in that direction.

So, I thank my colleagues for spearheading the leadership on this particular piece of legislation, and I know that you know that my assistance will certainly be there.

[The prepared statement of Ms. Schneider follows:]

STATEMENT OF
THE HONORABLE CLAUDINE SCHNEIDER
SRT HEARING ON H.R. 4715, THE TECHNOLOGY CORPORATION OF AMERICA

DURING THE PAST DECADE, THE U.S. TRADE DEFICIT HAS GROWN ALARMINGLY FROM $36 BILLION IN 1980 TO $109 BILLION LAST YEAR. THE RISING TRADE DEFICIT IS A CONCERN FOR ALL AMERICANS. IN RHODE ISLAND, FOR EXAMPLE, ABOUT 12 PERCENT OF THE EMPLOYMENT FORCE IS EXPORT RELATED.

ONE ISSUE REPEATEDLY BROUGHT TO MY ATTENTION AS CO-CHAIR OF THE CONGRESSIONAL COMPETITIVENESS CAUCUS IS THE ADVERSE EFFECT THAT THE HIGH COST OF CAPITAL CAN HAVE ON INVESTMENT AND INNOVATION IN THE UNITED STATES.

RECENT ESTIMATES IN *THE FEDERAL RESERVE QUARTERLY REVIEW* SHOW THAT COST OF CAPITAL WAS TWO TO THREE TIMES HIGHER FOR U.S. FIRMS THAN THEIR WEST GERMAN AND JAPANESE COUNTERPARTS. THE PROBLEM OF OBTAINING SUFFICIENT DOMESTIC CAPITAL TO DEVELOP FULL-SCALE INDUSTRIES FROM NEWLY DESIGNED PRODUCTS APPEARS TO BE PARTICULARLY SERIOUS FOR SMALL AND MEDIUM-SIZED COMPANIES.

FURTHERMORE, HEARINGS BEFORE THE SCIENCE, SPACE AND TECHNOLOGY COMMITTEE REVEALED THAT GOVERNMENT POLICIES AFFECTING THE COST OF CAPITAL, INCLUDING PROCUREMENT AND TAX LAWS, ARE OFTEN THE FACTORS WHICH DETERMINE WHETHER CERTAIN PRIVATE SECTOR TECHNOLOGY DEVELOPMENT VENTURES GO FORWARD.

FOR THESE REASONS, I AM PLEASED THAT WE HAVE CONVENED THIS HEARING TO EXAMINE THE APPROPRIATE ROLE OF THE FEDERAL GOVERNMENT IN ENHANCING THE TECHNOLOGICAL ADVANCEMENT OF PRIVATE INDUSTRY IN THE UNITED STATES. I AM PARTICULARLY PLEASED TO WELCOME A DISTINGUISHED WITNESS, IRA MAGAZINER, OF RHODE ISLAND. IRA MAGAZINER IS AN INDIVIDUAL OF MANY TALENTS: AN ENTREPRENEUR, ENVIRONMENTALIST, NOTED AUTHOR, AND BUSINESS ADVISOR.

HE HAS DEDICATED THE PAST SEVENTEEN YEARS TO CONSULTING ON CORPORATE STRATEGY AND ECONOMIC DEVELOPMENT POLICY ON AN INTERNATIONAL LEVEL. RECENTLY, HE HAS WRITTEN AN ESPECIALLY PENETRATING WORK ON GLOBAL COMPETITION, *THE SILENT WAR: INSIDE THE GLOBAL BUSINESS BATTLES SHAPING AMERICA'S FUTURE*.

THE SILENT WAR CONCLUDES THAT THE U.S. WILL HAVE ITS WORK CUT OUT IN GLOBAL COMPETITION, BUT THROUGH ACTIVE POLICIES THAT MORE STRONGLY SUPPORT RESEARCH AND DEVELOPMENT, WORKER EDUCATION AND TRAINING, AND LONG-TERM PRODUCTION INVESTMENT, WE CAN COMPETE WITH LOW-WAGE AND HIGH-TECH FOREIGN COMPETITORS.

THIS WORK IS RECOMMENDED READING FOR MEMBERS OF THIS COMMITTEE, AND I AM GLAD TO SEE MR. MAGAZINER HERE TODAY TO SHARE HIS FORWARD LOOKING WISDOM WITH US.

Mr. LEVINE. Mr. Chairman, even though that wasn't a question, would it be okay to respond briefly to—

Ms. SCHNEIDER. No, that was my opening statement.

Mr. VALENTINE. Absolutely.

Mr. LEVINE. Thank you, Mr. Chairman. I really don't want this opportunity to pass without complimenting the gentlelady from Rhode Island for the leadership that she has given in this entire competitiveness area for a considerable period of time. I've spent many hours at briefings and meetings that she has put together and chaired. Actually, as she was making her very gracious and thoughtful comments I was thinking about a meeting that we had in Boston several years ago, where Bob Solow was talking about a number of these competitiveness issues at the home of George Hatsopoulos, where the gentlelady was, perhaps, as eloquent as anybody in the room.

And having her support for this legislation means quite a bit to me, as I know it does to my friend Mr. Ritter. She is one of the people in the Congress who has been most involved in these issues, and, frankly, it is very gratifying when one takes a look at this particular subcommittee that is probably more knowledgeable, I would say definitely more knowledgeable as a body, than any other subcommittee because of the fact that it is your area of jurisdiction. It is something that you spend the most time on. You spend more time on this than other members do simply because it's your area of oversight and responsibility. And having the kind of both bipartisan and broad support for this legislation and for these issues in general, as the subcommittee consistently demonstrates—and demonstrates in this bill, and as the gentlelady has again demonstrated, frankly gives me some hope in terms of where we are headed in terms of policy coming from this Congress.

So I want to thank the gentlelady for her leadership and for her support, and compliment her for it.

Ms. SCHNEIDER. Thank you very much.

Mr. VALENTINE. Thank you. Mr. Ritter?

Mr. RITTER. If I just might add a few words to my friend from California. First of all, I want to associate myself with his remarks. They're right on target when he talks about the gentlelady from Rhode Island. As a matter of fact, I'm so enthusiastic about her contribution to this field that I would be delighted to be her House counterpart on key competitiveness issues when she arrives in the United States Senate. And that's not said in a partisan tone—

[Laughter.]

Mr. RITTER. —although it may appear. It's said in a tone of, really, I guess 10 years of working together with the gentlelady from Rhode Island on these issues. We may be missing her in the House, but hopefully we can join up with you in the Senate.

Mr. VALENTINE. I wouldn't dare suggest that there is anything, any similarity between the gentleman's very generous statement and what I heard about a sermon in my part of the world a few years ago, when the gentleman told the preacher that he had stopped preaching and gone to meddling.

[Laughter.]

Mr. VALENTINE. Mrs. Morella?

Mr. RITTER. Meddling.

Mr. **Valentine**. Stopped preaching and gone to meddling.

Mr. **Ritter**. Yes. Okay.

Mr. **Valentine**. Mrs. Morella?

Mrs. **Morella**. Thank you, Mr. Chairman. I think all I have to say in response to these wonderful tributes that have been genuinely offered is a line from Shakespeare: "Your fair discourse hath made the way sweet and delectable." And I think that our colleague from Rhode Island may well feel that way, and we do mean it very sincerely.

And I want to thank my colleagues for introducing this legislation, presenting it so well. And, Congressman Ritter, you actually answered a question I had wondered, and that was the Advanced Technology Program at NIST in the district I represent, in terms of whether it would be complementary. And you have answered that very well.

So, I look forward to the rest of the panels, and associate myself with the remarks of my three colleagues. Four colleagues. My chairman, of course.

Mr. **Levine**. Thank you, Mr. Chairman, and members of the subcommittee.

[The prepared statements of Mr. Boehlert, Mr. Bruce, and Mr. Costello follow:]

CONGRESSMAN SHERWOOD BOEHLERT (R-NY)
OPENING STATEMENT
HEARING ON TECHNOLOGY CORPORATION OF AMERICA
September 12, 1990

Mr. Speaker:

It's a pleasure to be here to gather testimony on H.R. 4715, which has been introduced by Mr. Levine and Mr. Ritter.

I doubt there could be many Members of this Committee who would oppose the concept underlying this bill. This Committee has repeatedly endorsed the notion that the government should be doing more to support civilian industrial research on high technologies. The Advanced Technology Program, which this Committee created in the Commerce Department, is the most significant evidence of the Committee's position.

So I see the question before us today as the more limited one of whether a Technology Corporation of America would be a useful mechanism to carry out this policy of industrial support.

I have to admit that I have my doubts. I wonder whether a quasi-government entity doesn't just create another level of bureaucracy and a whole new category of conflict-of-interest questions.

I also think that if this kind of aid is legitimate, the government ought to be honest and open enough to provide it outright, rather than hide behind some quasi-governmental entity. Would a TCA do more than enable government money to flow to industry while allowing public officials to say, "Look, Ma, no hands"? A purely governmental program, by the way, would not mean that industry would not play a major role in allocating funds. I think the preliminary plans for the Advanced Technology Program make that clear.

There are aspects of the TCA proposal I like. I think existing efforts are hamstrung by our efforts to carve out this murky category of "generic, pre-competitive" research. The TCA presumably could provide assistance further down the production cycle, where American firms seem really to be falling on their faces. But whether to do that, of course, is a major policy question, which can't be evaded simply by obscuring the government role.

I hope today's witnesses will be able to address these concerns. Thank you.

THE HONORABLE TERRY L. BRUCE
SUBCOMMITTEE ON SCIENCE, RESEARCH, AND TECHNOLOGY
SEPTEMBER 12, 1990

MR. CHAIRMAN, I WOULD LIKE TO COMMEND YOU FOR HOLDING THIS IMPORTANT HEARING TODAY ON THE CREATION OF A TECHNOLOGY CORPORATION OF AMERICA (TCA). IN ADDITION, I WOULD LIKE TO EXTEND A WARM WELCOME TO OUR COLLEAGUE MEL LEVINE, WHO IS THE SPONSOR OF THIS LEGISLATION. I AM CONFIDENT THAT THE GENTLEMAN'S EFFORTS, BOTH IN CONGRESS AND IN HIS "REBUILD AMERICA" ORGANIZATION, WILL PLAY A MAJOR ROLE IN IMPROVING THE COMPETITIVENESS OF U.S. INDUSTRY.

THE CONCEPT OF A FEDERALLY CHARTERED, INDUSTRY-LED TECHNOLOGY CORPORATION HAS GREAT PROMISE, AND I AM PROUD TO BE AN ORIGINAL COSPONSOR OF THE BILL ESTABLISHING ITS CREATION. THIS CORPORATION WILL BRING TOGETHER CONSORTIA AND PARTNERSHIPS FOR RESEARCH AND DEVELOPMENT, AS WELL AS THE MANUFACTURING OF EMERGING TECHNOLOGIES CRUCIAL TO OUR FUTURE ECONOMIC SUCCESS. MOREOVER, IN LEVERAGING A SMALL FEDERAL INVESTMENT WITH PRIVATE SECTOR FUNDING, THIS CORPORATION COULD EFFECTIVELY LOWER THE COST OF CAPITAL FOR HIGH-RISK VENTURES. ANOTHER IMPORTANT ROLE TO BE PLAYED BY A T.C.A WOULD BE TO HELP CONVERT THE CUTTING-EDGE RESEARCH PERFORMED IN OUR NATIONAL LABORATORIES INTO VIABLE COMMERCIAL PRODUCTS. I FIRST WORKED TO TURN BASIC RESEARCH INTO COMMERCIAL APPLICATIONS WHILE PUSHING LEGISLATION TO ALLOW THE ARMY'S CONSTRUCTION ENGINEERING RESEARCH LABORATORY IN MY DISTRICT TO SELL ITS RESEARCH TO THE PRIVATE SECTOR.

I BELIEVE THIS SUBCOMMITTEE MUST PLAY A LEADERSHIP ROLE IN ADVANCING THIS POLICY INITIATIVE. REGARDLESS OF THE RESISTANCE IN THE ADMINISTRATION TO AN INVESTMENT STRATEGY, WE MUST FACE THE FACT THAT MANY OF OUR COMPETITORS ARE FAR OUTSPENDING US IN CIVILIAN RESEARCH AND DEVELOPMENT. IT IS UNREALISTIC TO THINK THAT OUR COMPANIES CAN

COMPETE WITH FOREIGN CONGLOMERATES THAT RECEIVE THE FULL SUPPORT OF THEIR GOVERNMENTS AND FINANCIAL INSTITUTIONS. WHILE I SUPPORT LAISSEZ-FAIRE POLICIES IN PRINCIPLE, THE "TARGETED INDUSTRY" STRATEGY OF OUR COMPETITORS CREATES MARKET IMPERFECTIONS THAT WE CANNOT IGNORE. A TECHNOLOGY CORPORATION OF AMERICA, WORKING IN TANDEM WITH THE NEWLY CREATED, BUT UNDERFUNDED, ADVANCED TECHNOLOGY PROGRAM AT NIST, IS AN ATTEMPT TO LEVEL AN UPHILL PLAYING FIELD.

AGAIN, THANK YOU AND I LOOK FORWARD TO GAINING ADDITIONAL INSIGHTS FROM THE TESTIMONY OF OUR MANY DISTINGUISHED WITNESSES.

OPENING STATEMENT
BY U.S. REP. JERRY F. COSTELLO, ILLINOIS
COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY
HEARING ON A BILL TO ESTABLISH A TECHNOLOGY CORPORATION OF AMERICA
SEPTEMBER 12, 1990

Mr. Chairman, today we convene to discuss the need for a Technology Corporation of America (TCA). We will listen to the need to provide for the formation of an industry-run, government-chartered, nonprofit corporation to fund research, development, and manufacturing activities in strategic high technologies.

As competition with Japan and other countries continue to grow, so does the need to assist U.S. corporations. The Technology Corporation of America seeks to help offset the high cost of capital faced by U.S. corporations.

I am very interested in finding out if the Technology Corporation of America (TCA), as set out in Rep. Levine's H.R. 4715, is a prudent means of addressing the cost of capital in the U.S. and what are its advantages and disadvantages compared with other governmental means of lowering the cost of capital?

Mr. Chairman, I welcome our witnesses and I thank you for holding hearings on this legislation.

Mr. **Valentine**. All right. Thank you gentlemen, very much.

Our first panel consists of—all right, we're going to have all the witnesses. We had two panels originally, but we're going to ask all of you to come up together. The witnesses consist of Mr. Ira C. Magaziner, already introduced by our distinguished colleague—

Ms. **Schneider**. Not yet. Not yet. I didn't introduce him. I was just reading my opening statement.

Mr. **Valentine**. Oh, you just—okay. Excuse me. There will be further words about the gentleman, of course.

President of SJS, Inc., Providence, Rhode Island; Mr. Richard J. Elkus, Jr., Chairman of Prometrix, Santa Clara, California; Mr. Thomas H. Stanton, Olwine, Connelly and Chase, Washington, D.C.; Mr. Robert L. Stern, Consultant in Technology Management, from this city.

Welcome, all of you. And I recognize Ms. Schneider again for further words of identification and introduction.

Ms. **Schneider**. I will be succinct, Mr. Chairman, since we have had an enormous amount of discussion already this morning. But I am delighted to have the opportunity to introduce Ira Magaziner, who is an individual of many talents. The fact that he is from Rhode Island makes him particularly special, but he is also an entrepreneur and an environmentalist, a very noted author, and a business adviser. He has dedicated the past 17 years to consulting on corporate strategy and economic development policies on an international level, so that he has taken his skills beyond Rhode Island's borders, on a national but also international plane.

He has written this book, which I am doing a little free advertising for him, Mr. Chairman. I'm getting no commission on this, so you're aware of it. But his book, *The Silent War,* very significantly concludes that the United States is going to have to work out, work its way out of the global competition challenge through policies that strongly support research and development, worker education and training, a greater investment in long-term investment, and also the fact that by taking these various strategies—investment in R&D, in human resources, in providing for appropriate cost of capital—that we will be able to compete with the low wage, high technology competitors.

This work is, I believe, recommended reading for all members of the committee, and I am very honored that he has agreed to join us as an expert witness here today to share his very forward-looking wisdom with us.

I will say also I regret that I will not be able to stay throughout the entirety of the presentations of the other expert witnesses. But every word you say will be monitored by my very able staff, and I thank each and every one of the witnesses for your participation in this effort because I believe that the direction will clearly be taken, and the leadership will be taken by this committee to move our entire national government toward investments in an economy that will ensure our international competitiveness.

Thank you very much, Mr. Chairman. And I welcome you, Mr. Magaziner.

Mr. **Valentine**. Thank you.

STATEMENTS OF IRA C. MAGAZINER, PRESIDENT, SJS, INC., PROVIDENCE, RHODE ISLAND; RICHARD J. ELKUS, JR., CHAIRMAN, PROMETRIX CORPORATION, SANTA CLARA, CALIFORNIA; THOMAS H. STANTON, OLWINE, CONNELLY, CHASE, O'DONNELL & WEYHER, WASHINGTON, D.C.; ROBERT L. STERN, CONSULTANT IN TECHNOLOGY MANAGEMENT, WASHINGTON, D.C.

Mr. MAGAZINER. Thank you very much. And thank you, Mr. Chairman, for this opportunity to testify.

What I'd like to do is take about 5 minutes and describe some experiences from the consulting practice that I've been part of. We get the opportunity to see every year a couple of hundred competitive battles, if you will, that take place in different industries among companies from different countries, and to be inside those battles seeing what really effects the outcome, and it is based upon that experience that I'd like to speak.

And, in particular, I'd like to speak about what I see as having been the most important and alarming trend in causing outcomes in a whole series of industries that we've been involved in over the past 2 years. And that trend, put simply, is American companies who have technology leadership in certain areas who are basically having to sell out that leadership in one form or another to foreign competitors because of lack of capital.

It is the fastest growing area of the consulting business. It is the fastest growing area of the investment banking business to assist foreign buyers to buy American technology. And it's frightening. And I'd like to talk a little bit about why it's happening and what the implications are, and tell one or two stories that are real stories that can give you an idea of what's happening.

In industry right now there having to be faster development cycles. New products have to be brought out much more frequently than ever before in order to remain competitive. The average cycle in a lot of industries used to be 3 to 4 years. It's now down to about 12 to 18 months. And what that means is that you have to keep a couple of generations of new product being under development at the same time, simultaneously. So, while you're working on the product you're going to bring out next year, you're also having teams work on the product that's going to come after that and then the technology that's going to come after that, and you've got to do that simultaneously, which has drastically increased the total cost of R&D to stay competitive.

U.S. companies are at a disadvantage increasingly in being able to do that. We've talked about the high cost of capital. Also there is the pressures of the stock market system that we have which forces a short time horizon onto industry. And also, there is no government backing here for commercial research and development the way there is in Europe and Japan.

We recently had a client, a major American producer of materials, advanced materials, ceramic materials, who had a technology lead in certain areas in composites, and they asked us to do a strategy study on what markets they should pursue, and we did that. And what we found is that they had 2 Japanese competitors and 1 German competitor, who were still behind them but who were receiving major amounts of public funding. In Europe, it was under the Eureka program and also under a German Ministry of Technology program, and in Japan it was from the Agency of Industrial Science and Technology.

And these programs were funding the development of prototypes in applications for these technologies. The American company who has a subsidiary in Japan asked to participate in the AIST project, but was turned down, so that they would not have access, basically, to the specifications for these applications nor the sharing or pooling of R&D that was going on.

As we looked at the horizon and looked at what was happening, we basically had to recommend to the company, and it was not something that was very pleasant to recommend, that basically the commercial applications would not be ones in which they could win competitively. That if they were going to do anything it would probably have to be in certain defense applications where they could get similar assistance from the Defense Department to what was being given to their foreign counterparts in the commercial applications.

If we had gone to them and said, "Look. Adam Smith and economic theory says that these governments shouldn't be doing that and therefore we're going to give you a strategy, assuming that they are not doing that," we wouldn't have been employed very long. These companies have to deal in the real world, and the real world is that their foreign competitors were being able to leverage a third of the investment and get twice the benefit because of those government programs. And those programs were going to go on for 3 to 5 years and our client couldn't afford to keep up. That is the real world that is out there and we see that every month in consulting assignments that we have for companies in this country.

The result of that is that foreign companies now are making a series of strategic investments in U.S. companies as a matter of policy to try to, basically, again access to technology. The way this takes form, usually if it's a large U.S. company, there will be a joint venture where the U.S. company will basically be supplying technology and the foreign company money to help develop the new program. If it's a small U.S. company, sometimes it's an outright takeover and sometimes it's what is called a strategic investment, where the Japanese company will invest and take over 10 or 20 percent of the company, but their real interest is in getting access to the technology to then bring back home.

We have 15 to 20 years of experience in joint ventures that have gone on between Japanese companies and U.S. companies, and generally it has been my experience that Japanese companies going into these ventures assuming that they're going to end at some point, and with a very clear strategic sense of what they want to get out of the joint venture during the course of it.

And the same thing is happening in a lot of these strategic investments that are taking place. We are basically trading away technology for money, and that money is short-term money which will keep us afloat today but doesn't necessarily guarantee where we're going to be 5, 7, 8 years down the road. And in doing that I think we are strengthening our foreign competitors and jeopardizing our own.

The bill that's before us I think is a good first step, and that's why I agreed to come and testify here. What we ultimately need is something in the order of at least $6 to $8 billion a year of commercial research and development public funds in this country. And I arrive at that on no complicated basis. It just simply would match what is going on in Europe today, for example. If you take the public programs that exist under EUREKA, ESPRIT, RACE, BRITE, JESSI—the whole series of Europe-wide programs—and you add them to the individual programs that go on through individual Ministries of Technology and other comparable bodies in the European countries, you see basically about $6 to $8 billion of public funds which is going on a matching basis to funds that companies are putting up themselves to fund over 600 different projects that are pioneering products for the 1990s. This is not basic research. This is product development. It is a simple, practical matter that if we don't keep up with that, we're not going to be able to keep up economically.

In Japan the system is more complex. The amount of money spent in public funds is somewhat less, but it is still in the billions. And the complex system that operates in Japan in terms of how industry is financed overall means that you have more private funding, but there is a significant amount of "off government balance sheet supports" which are given which help the companies to make those funds.

It is a practical matter. It is not an ideological matter. We have to start matching those expenditures. If you go back in history, there has never been a world economic leader that has not been a world technology leader. In Europe and in Japan, it is a common understanding that they need to be present in all major new technologies of the next decade or two decades. It's also a common understanding that companies operating on their own in a private enterprise setting are not going to be able to put sufficient funding to the longer term projects, and therefore government has a role to play.

I think we need to come to that realization in this country. I see this bill as a first useful step in that direction, and I commend you all for introducing it, and I hope it will be passed.

Thank you.

[The biographical sketch of Mr. Magaziner follows:]

BIOGRAPHICAL MATERIAL

IRA C. MAGAZINER

Ira C. Magaziner is currently president of SJS, Inc. a consulting firm providing assistance to groups addressing economic and social issues facing America in the 1990's. Previously, he was founder and president of Telesis, an international consulting firm specializing in corporate strategy and economic development policy. Mr. Magaziner continues as a consulting associate of Telesis.

During the past seventeen years he has managed corporate strategy studies for companies based in the United States, Japan, Germany, Sweden, England, France, Australia, and Mexico. Clients have included General Electric, Corning Glass Works, Volvo, Black & Decker and Rubbermaid. He has also managed studies for the Prime Ministers and the Ministers of Industry of several countries, incluing Sweden and Ireland

He has coauthored a number of books including *Japanese Industrial Policy* (1980); *Minding America's Business: The Decline and Rise of the American Economy* (1982); and *The Silent War: Inside the Global Business Battles Shaping America's Future* (1989).

He is on the Board of the National Center for Education and the Econom[illegible] Tougaloo College, RE: Learning, and the Qualit[illegible]cation for Minorities Network. He is co-cha[illegible]ong with former Labor Secretaries Ray Marshal[illegible] Bill Brock, of the Commission on Skills of the American Workforce. He was a visiting professor at the University of Rhode Island, a Visiting scholar at Bryant College and is on the Editorial Advisory Board of The Sloan School Management Review at MIT.

He is also a member of the boards of several Rhode Island organizations including Save The Bay, Workforce 2000 Council, The International Institute of RI, Rhode Island Group Health Association, Providence Public Library, Community Services of Southeastern New England, Jewish Federation, Community Preparatory School, The Music School, and the Spirit Program.

Mr. Magaziner graduated as Valedictorian from Brown University in 1969 and has served on its Board of Trustees. He also attended Balliol College Oxford as a Rhodes Scholar. He, his wife - Suzanne, and children - Seth, Jonathan, and Sarah, reside in Bristol, Rhode Island.

Mr. **Elkus**. Thank you, Mr. Chairman, and members of the committee. First of all, I'd like just briefly to give you my background, simply as a gauge in which I'm going to make my comments.

I am chairman of a National Science Foundation panel on high-definition products and systems. I'm director of the American Electronics Association and former co-chair of the American Electronics Committee on High-Definition Systems. I'm a director on the Advisory Board of the Center for Strategic International Studies. I'm also with Economic Strategy Institute.

In my career at Ampex Corporation I presented the first product plan and headed up the original team that introduced the VCR to the world. At the time we had a 100 percent patent position in the field. There isn't any firm in the world that doesn't do—that doesn't produce VCRs under a license on those patents today.

I'm also, I'm now chairman of Prometrix Corporation. Prometrix Corporation is in the semiconductor equipment field, test instrumentation. I'm chairman and CEO. I'm also chairman of Integrated Systems, a public company in the field of computer software of a fairly sophisticated nature.

The comments I'd like to make are in the following vein:

Number one, I want you to know that I feel that the efforts toward this bill are exemplary, and I think there are very great reasons why in some form this bill should be passed. And so what I'm about to say is no way considered to be not in support of this bill. But I would like to take a different approach than I think most people on this panel would take and, as a background, I'd like to tell you that I've been an entrepreneur in Silicon Valley for quite a while. I have had more than the companies just mentioned. Fortunately, by the grace of God and good luck, they have all been successful.

I have some feel for how Japan operates. I've been there in various ways for 20 years. I know Aki Morita and Sony intimately. I know Sumitomo and that corporation relatively well. I consider many of the Japanese both my friends and associates. I'd also like to say that the comments that I have to make today in no way should be considered to be contrary to the interests of Japan or in any way considered to be negative with respect to Japan or any other country. I also would like to say that they are my own.

First of all, there is a case in Harvard on the semiconductor industry, and that case has on the very top a statement that I made sometime ago which said that "He who owns the semiconductor industry owns the world." Now, they didn't include something that I would have added if I had stuck that statement in there. It goes something like this: You don't control the semiconductor industry by investing money in the semiconductor industry.

Number two, I'd like to point out that in my estimation the problem that the United States has with technology is to some extent related to the high cost of capital, to some extent related to problems with capital gains taxes, but that is in no way the fundamental problem. And, as a matter of fact, to my way of thinking you don't keep your technological base primarily by concentrating on investment in technology.

Number three, we spend a lot of time talking about the educational system in this country and the problems associated with education as it bears on our technology and our industrial base, and I would like to suggest—and I'll try to make this point both now and, I hope, in questions and answers—that the fundamental problem in education is not residing in the fact that we spend too much or too little in education.

Now, let me tell you what I think the problem is and to an extent how this committee, this bill bears on it. We are sitting in the Middle East today with the largest force ever sent via air in the history of this country. We are sitting in the Middle East today able and willing my guess is, if the circumstances were appropriate, to go to war at a moment's notice. And there has been all kinds of discussions about that around the world.

Now, the reason we are willing to do that, and the reason why we sit with all the troops and all the armaments in the Middle East, there is an end-use product called oil. Oil as an end-use product everybody knows is strategic to every aspect of every economy on this earth. It's fundamental to the chemical industry. It's fundamental to the paper industry. It's fundamental to making potato chips. It's fundamental to the banking system. It has control over interest rates, credit—everything. Oil as an end-use product is strategic to every aspect of our life, and everybody knows it.

In addition to that it is not obvious how you create oil from something other than digging a hole in the ground. There are ways, but not obvious ways. By the way, I've had a company in the geophysical instrumentation business as well. In the field of oil, you've got to go where you can get it most easily out of the ground, and it just so happens that if you are starting to dig up oil in Saudi Arabia you are going to pay 100 times less than finding that oil in the United States.

Also, the reserves in Saudi Arabia, and I might also add Russia, tower over the reserves anyplace else. Moreover, we have an interesting situation. We have a very obvious enemy who is trying to control that oil to the detriment of the whole world, let alone the United States, and that amount of power in a bad guy can destroy everybody. And we know that, and we're willing to go to war over it.

Now, the reason why everybody accepts this is because it's so obvious and we've talked about it always, and it's not something that comes easily to our pipelines from the United States of America for all kinds of reasons. I would like to suggest to you that oil is not the only strategic end-use product on this earth. As a matter of fact, my guess is that if you look at how end-use products and markets develop over time, as you push their development to their logical extreme they all, every single one of them, come together.

The comment is always made lightly about potato chips and semiconductor devices. You don't make potato chips today without semiconductors. You're not even in the business. If you're in Perrier and you got benzene in the water because the information system didn't tell you on time, you're out of the water business. All products and markets pushed to their logical extreme become interrelated.

Now, let's assume that what I'm saying is correct for a second. Then the following conclusions can occur. And I assure you the Japanese understand this fully, and I commend them for it.

Number one, if you own strategic interrelated or have major positions in strategic interrelated end-use markets, as the infrastructure grows closer and closer together, you dominate all of the technologies, component development, educational systems, everything in support of those markets. Never, absolutely never the other way around.

When we introduced the VCR we had 100 percent patent position in the world. It still holds. At that point in time there were 16,000 video recorders produced a year. Ampex was at the pre-eminence of that entire field. Sony took a license on that from Ampex—willingly. Ampex was willing and so was Sony. And I can discuss that later if anybody cares.

Today, if you want to ship a VCR, you will notice that instead of 16,000 units a year you're talking 2-1/2 to 3 million units a month in Japan alone. When we introduced the VCR it cost a million and a half dollars. A million and a half dollars to develop it. When we introduced the VCR it would have cost $2 million max to produce an operating facility. Today, if you want to be in the VCR business, you will spend $600 million to build a factory. But you can't even consider being in the VCR business unless you are pre-eminent in 35 millimeter cameras, in optical disc recorders, in audio recorders, audio cameras—I mean, video cameras, unless you're in the CD business, in the media, and heavily in semiconductors. Today, if you want to develop a 64-megabit D-RAM, to give you an idea of what we're talking about—that's a single chip, memory chip, which will be indigenous to all computers of the future as time goes on. I can tell you one company in Tokyo that is spending $1.5 billion for research and development only. That is $100 million more than the entire supercomputer market for a year.

Now, if in fact markets and products are totally connected, then you have an interesting problem. If you operate on the basis of opportunity costs, and therefore you walk away from certain products and markets because you can't make enough money and you can make somewhere else, it is only a matter of time before you walk away from all the markets that you are currently in and expect to make your money from. Because everything gets tied together.

Today, if you want to be in the VCR business, there is no one technology or product or market that can possibly give you an edge in that industry other than the end-use market itself. And you have to be in many end-use markets, and heavily so, in order to be competitive.

Let me talk for one second about the automobile industry. The automobile industry is on its way to failure in this country if it continues in its current bent, but not for the reason that most people think. If you take a look at what is happening to the automotive industry, and I might also add the aircraft industry is not far behind, you will find that over the next 10 years 35 percent of an automobile will be made from electronics, and 50 percent of an aircraft. The problem with the automobile industry is that all kinds of portions of the electronics industry which we no longer have indigenous to this country, that is, the end-use products, are finding their way into the automobile, and the resulting end-use product, the automobile, in all of its component parts is becoming noncompetitive in U.S. markets with no real access, except through your major competitor, for those products and components necessary to support the automobile.

My conclusion is simply this:

Number one, we need and must develop a national strategy that can learn—help us achieve leverage with the markets that we've got left to get back into the markets that we have left.

Number two, that national strategy has to be based fundamentally on the ability for all aspects of this community of companies, people and government in the United States to talk together about what's going on and how one aspect of our economy affects another.

In terms of this bill, the beauty of this bill properly constructed is that it is at least an attempt to get all kinds of industry together with government to discuss in fact where we stand on end-use markets for products, where they go if we don't, where they go if we do.

The last thing I would like to say is this. I come from Silicon Valley. I've made a few bucks in Silicon Valley because of what has transpired there. The world admires the place. The reason why we're losing companies and technology in Silicon Valley is not the cost of capital. It's because those boys and ladies there have no place to sell their products anymore except to a foreign source.

When Columbia Pictures was bought by Sony, it wasn't bought to make a buck on Columbia Pictures. It was bought to integrate the technology of Columbia Pictures and CBS Records with the electronics. Let me tell you in one word where this world is going. There is going to be a market by the end of the year—by the beginning of the year 2000 called the information systems market. It is going to be dominated by one—by three end-use markets that will become one, not three: the media, and I mean all media; telecommunications, and I mean all telecommunications; and the entire electronics industry. And what is going to force that together, and I can discuss it later on, is the ability to handle huge amounts of information. That is the reason for high definition, no other.

When that happens the Japanese expect that their pre-eminence in those three markets, which will become one, will give them a dominant effect in all markets around this globe. That's what they will trade and have traded for oil. When we are out of that the cost of getting back in is absolutely beyond belief. This is a fundamental problem to this Nation, a fundamental problem to the Department of Defense, a fundamental problem to the world at large. Nineteen ninety-two in Europe is not here because of some desire to get together in the various countries to improve the standard of life. It is here to beat the technological and competitive marketing industrial game produced by Japan in what I consider to be an exemplary fashion, putting aside any trade problems that may exist because of it. That's what I'd like to talk. That's what I think, in part, this bill does address.

Thank you.

[The prepared statement of Mr. Elkus follows:]

THE STRATEGY OF LEVERAGE

Richard J. Elkus, Jr., Chairman
Prometrix Corporation

SEPTEMBER 12, 1990

The United States operates on the theory of opportunity cost: If you can make more money elsewhere, do it. Japan feels that walking away from the development of end use products and markets based upon the strategy of opportunity cost destroys the economic infrastructure of inter-related products and markets that is fundamental to technological development. It is felt that such a strategy will only enhance the relative position of the competition.

During the 1940's and 1950's, three United States companies created industries that became the foundation for many of the strategic world markets of today. RCA was instrumental in the development of television. Shockley Transistor Company spawned the semiconductor industry. Ampex Corporation developed the field of magnetic recording. Today, television, telecommunications, computers, consumer electronics and mass media have a significant portion of their roots in the contribution of these three companies.

As of 1970, America was virtually self-sufficient as a nation. It encompassed the world's biggest market, produced more products and had the largest trade surplus of any nation on earth. America's currency was of the most solid in the world, and America's banks were the biggest.

Today, only one U.S.-owned company produces television sets (not RCA). The television market is dominated by Japan and Europe. Today the United States is virtually a non-participant in the market for audio and video recording. Today the United States is no longer the largest producer or clear technological leader in semiconductor design and manufacture. The United States surplus balance of trade in computers is less than half of what it was in 1981. Moreover, America has a negative balance of trade in computers and related products with Japan.

In a chart entitled "U. S. Report Card: Trends", the Technology Administration branch of the U. S. Department of Commerce in their Spring of 1990 Report on twelve emerging technologies noted that in comparison with Japan, the U.S. was:

- Losing Badly in Advanced Materials, Biotechnology, Digital Imaging Technology and Supercomputers
- Losing in Advanced Semiconductor Devices, High-Density Data Storage, High-Performance Computing, Medical Devices and Diagnostics, Optoelectronics, and Sensor Technology

- Holding in Artificial Intelligence, Flexible Computer-Integrated Manufacturing
- Gaining in None.

The change in balance of economic power between the United States and Japan over the last 45 years has been staggering. In the view of R. Taggart Murphy as expressed in the March/April issue of the Harvard Business Review, "Japan today sits on the largest cache of wealth ever assembled."

Why a change of this magnitude in such a short time? Imagine that products and markets are like links in a chain. If you take a product and carry its development to a logical extreme, it becomes related to other products. For example, the optical system on a 35mm camera is similar to the optical system on a video recorder. Conversely, the electronic imaging system that is common to a video recorder is now beginning to be substituted for film in a camera.

Similarly, if you develop a market to its logical extreme, it becomes related to other markets. For example, the development of the market for VCR's made possible the market for pre-recorded videotape which is now a larger market than that of film in theatres. Conversely, if manufacturers of pre-recorded videotape choose one VCR format over another for their programming, that choice tends to influence the popularity and growth of the market for VCR's. Thus, like links in a chain, products and markets become inter-related and inter-dependent as they are developed.

In the electronics market there is one component common to virtually all electronics products - the semiconductor. Control enough links in the chain such as the markets for video recording, cameras, audio recorders, television, and computer products, and you become predominant in semiconductors. Become predominant in the design and development of semiconductors, and your prowess as a developer of other electronic products and markets increases substantially. Electronic products are fundamental to virtually every market there is. Thus, a chain of markets linked together begins to control a technological base of such significance that competitive re-entry is very difficult and expensive.

One often hears how we must improve our technological base. Technology follows markets, not the other way around. If you own the technology, but lose the market, you will lose the technology. Ampex introduced the video tape recorder in 1956 and the VCR in 1970. As a company it had a virtual 100% hold on patents in the field. Ampex decided not to pursue the VCR market. That market was picked up by the Japanese. With that market went not only the majority of video recording but a major segment of the support technologies including the design and manufacture of semiconductors.

The development of high definition products (for example, HDTV) by the Japanese represents a major improvement in the processing of large amounts of audio visual information. High definition products will touch virtually every aspect of human creativity. For example, high definition television doubles the horizontal and vertical resolution of television providing five times the visual information and as a result, spectacular pictures and sound. These advancements are made possible in part by major improvements in computer display and semiconductor technology.

Because of the breadth of applications and cost of development, no industry, technology or company will be able by itself to meet the challenge and opportunities of high definition products and systems. As the compact disk redefined the music industry, high definition products will redefine mass media. With major advances in digital technology, high definition products will redefine computers and their applications. With alternate means of transmission, high definition products will redefine the broadcast industry, shopping, medical electronics, education and banking.

As Japan introduces a full line of high definition products, it insures itself of major advancements in: cameras and recorders, fiber optics and satellite transmission systems, VCR's, computers, flat screen displays and semiconductors--all markets in which it has a major if not commanding position.

The infrastructure in electronic products and systems (now in place in Japan) will ultimately become one with that of the media and telecommunications services as the ability to process massive amounts of audio visual information increases. This is part of the reason for Sony's interest in CBS Records and Columbia Pictures.

As the Japanese position in strategic interrelated end-use markets has improved. the cost of competitive re-entry by others has often become prohibitive. This, in large part, has occurred because of the interrelated nature between products and markets. Today individual products and markets are really a combination of many interrelated technologies, components, products and markets. For example, the technology of putting pictures on tape was of supreme importance 20 years ago. But now, high levels of sophistication in digital signal processing, display technology, camera and optical know how, semiconductor technology, computer technology, high-volume fully-automated manufacturing capability and mass marketing, sales and distribution systems are required to compete in the market for video recording.

But other costs also rise. For example, the development of a semiconductor device that cost a few million dollars a few years ago may cost in excess of a billion dollars today. Similarly, the cost of a VCR facility 20 years ago would have been less than $10 million. Today that facility might cost as much as $600 million.

Hence, while the United States may be willing to drop a product or market on the basis of "opportunity cost" and reinvest in a more lucrative enterprise, Japan will often do just the opposite. Because of the concept of relationships between products and markets, the Japanese feel that to abandon a product or market means the potential loss of other related products and markets and, therefore, the loss of valuable infrastructure. It is this infrastructure--that is, strategically related end-use products and markets--that provides the basis for future economic growth and development. The concept of relationships and infrastructure is common throughout Japan and is fundamental to the acceptance of and necessity for long-term planning.

Assuming that the combination of the markets for electronics, telecommunications and media is the basis for entry into the information age and recognizing that high definition products and systems are fundamental to the confluence of these three market areas, the following conclusion should be considered: Any significant loss of infrastructure of end-use products and markets within the area of electronics, telecommunications and media may substantially reduce the growth potential of an economy dependent upon that infrastructure. The Japanese feel, and statistics tend to bear this out, that the infrastructure represented by the markets for electronics, telecommunications and media are of major significance to the economic and political development of the United States, Japan and Europe. Lose control of one, and you may lose control of both.

Can the U.S. turn the tide in its favor? Absolutely. The U.S. computer industry is still dominant. America's position in mass media, software and transmission services is still solid. These markets can provide a basis for restoring America's competitive position. But such an effort must also include strategic moves back into consumer electronics, display systems, audio and video recording, computer peripherals, components, and related technologies. Otherwise, the combination of developments in high definition products and those markets America has lost will continue to encroach on remaining U.S. positions of strength.

One definition of chaos is fear without strategy. Rapid changes in the balance of economic power between nations without an appropriate strategy to address that change creates economic and political uncertainty. Uncertainty breeds fear.

Couple a modicum of fear with strategy and the United States can again be the most competitive nation in the world. On the other hand, allow fear to reign without strategy and American leadership is up for grabs.

RICHARD J. ELKUS, JR.

B.A. Stanford University, 1957; MBA Tuck School of Business Administration, Dartmouth College, 1959

Production Control Manager, Ampex Corporation, Redwood City, CA from 1959-1964; Assistant to President 1968-1971; Member of Operations Board, 1969-1971; General Manager Educational and Industrial Products Division, 1969-1972 (1970-Introduced America's first entry into the VCR market.)

President, Chief Executive Officer and Director, Eyrle Company, Santa Clara, CA 1964-1967

General Manager, Gould Medical Systems, Santa Clara, CA 1973-1974

Executive Vice President and General Manager of Geometrics, Inc., Sunnyvale, CA 1974-1980

Director of Acacia Sales Corporation, Sunnyvale, CA 1973-1983

Director Pacific Measurements, Inc., Sunnyvale, CA 1974-1983; Chairman, 1980-1983

Chairman, Chief Executive Officer and Director, Prometrix Corporation, Santa Clara, CA 1983-Present

Director and Chairman of the Board of Integrated Systems, Inc., Palo Alto, CA 1985-present

Director and a Founder of Tomex Corporation, Sunnyvale, CA 1982-1987

Member ex-officio N.H. Governor's Fee Schedule Committee 1958-1959. Served to capt. USAR, 1957-1965

Chairman, National Science Foundation Panel on High Definition Products and Systems, Co-Chair American Electronics Association Committee on High Definition Television

Vice Chairman, Government Policies Committee (High Resolution Systems Task Force - Defense Science Board)

Advisory Board Member, Center for Strategic and International Studies

Advisory Board Member, Economic Strategy Institute

Member, Board of Directors, American Electronics Association

Member Past or Present: American Management Association, Electronics Association California, Semiconductor Equipment & Materials International, SEMI/SEMATECH, Association for Corporate Growth, U.S. Chamber of Commerce, Council on Competitiveness

Mr. **Valentine**. Thank you, sir.

Mr. Stanton?

Mr. **Stanton**. Thank you, Mr. Chairman, Congresswoman Morella. It's a pleasure to be here today, and thank you for the invitation.

My name is Thomas H. Stanton. I'm a Washington, D.C. attorney whose practice includes a variety of matters relating to financial institutions and Federal credit programs. I'm speaking today only for myself, and not for any client or for my law firm. These comments are necessarily general in nature.

The subcommittee is to be commended for holding hearings at an early stage of the legislative process to provide the opportunity for the Congress to address the financial and institutional issues that must be resolved before the TCA is proposed in final form. And what I would like to try to bring to the table today is a concept of attempting to design public and private institutions to maximize their ability to actually get done what we want to have accomplished.

My comments on the legislation can be summarized as follows:

First of all, there is a very heavy burden on supporters of new Federal programs to ensure that they in fact will be financially viable and that they will provide maximum benefits per dollar of Federal support. A disturbing number of Federal programs, especially Federal credit programs today, are in extreme financial disarray.

Second, the TCA [Technology Corporation of America] can maximize its net benefits if it is designed to overcome what economists call market imperfections. A market imperfection is a problem, often caused by law or regulation, that prevents an efficient allocation of capital or other resources. At the modest levels of funding contemplated by H.R. 4715 it is not appropriate to think of the TCA as providing credit assistance benefits that are familiar from other credit programs. TCA simply doesn't have enough money to buy down interest rates or generally to provide loans on more attractive terms than market rate loans for any significant number of companies or ventures.

Moreover, any effort to provide credit assistance without correction of market imperfections run a dual risk well known from other Federal programs. Either that the assistance creates unacceptable levels of financial loss—in short, we're subsidizing losers—or that the assistance merely displaces credit that would have been provided in comparable, not necessarily identical, form by provide institutions even without Federal involvement.

Third, assuming that a clear market imperfection has been found and analyzed, the TCA and its activities must be carefully designed to address that imperfection. When I listened to Mr. Elkus talk about the range of problems facing us today, and I note that H.R. 4715 talks about a 3-year authorization of $150 million, the first question is whether that level of funding is at all commensurate with the level of problem we're talking about? And if not, the question for TCA is how do we get the maximum impact for that limited amount of funding?

Only when market imperfections are expressly identified can we structure the TCA so that it has the greatest likelihood of overcoming those imperfections and serving public service with the greatest effect and efficiency. If market imperfections exist, then there can be ways that the TCA can demonstrate innovative approaches or other benefits beyond the limited Federal funding that is available. And, in the testimony you will find a list of some of the Federal credit programs—the Farm Credit System, the FHA, other programs—that have pioneered various financial innovations, including the long-term mortgage, including fostering private mortgage insurance, title insurance, other financial innovations that were then available for other companies to imitate. And what TCA will have to do if it is bringing people together in consortia or joint ventures is provide a model so that it doesn't merely benefit those that it has brought together, but so that it provides others in the private sector an incentive to imitate what TCA has done in other ways.

Once the Federal program—fourth, once the Federal program has been appropriately designed to achieve maximum public benefits, then questions of institutional structure must be addressed to assure that the TCA has the organizational capacity and proper incentives to carry out its public purposes. A threshold question is whether the TCA should be designed as a privately owned, privately controlled corporation or whether it should be a government agency. This choice should be made explicitly.

Misshapen Federal programs ranging from the late Federal Asset Disposition Association and U.S. Synthetic Fuels Corporation to today's Resolution Trust Corporation show the dangers of distorted incentives and inadequate institutional capability that can result from flawed organizational design. The current form of the TCA as reflected in H.R. 4715 could use some revisions in this regard.

My preliminary judgment is that the institution should be designed to be completely privately owned and should be structured to receive grants, loans and other funding from governmental and private sources. Assuming that the TCA is to receive Federally appropriated funds, the decision whether or not to provide those funds should be made by Federal agency officials under legislative and regulatory guidelines designed to structure their discretion to assure that the Federal support will in fact help TCA serve its public purpose of overcoming designated market imperfection.

In conclusion, the subcommittee is to be commended for exploring the important issues concerning creation of the Technology Corporation of America at an early stage of the legislative process. Careful attention to the financial and institutional issues inherent in this legislation can help maximize benefits and reduce the potential costs of this Federal endeavor. At a time when America's high technology companies face relentless international competition, sometimes backed by institutions of foreign governments, such careful consideration is especially important.

Thank you.

[The prepared statement of Mr. Stanton follows:]

Statement of

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Presented to

The Subcommittee on Science, Research and Technology
Committee on Science, Space, and Technology
U.S. House of Representatives

Hearings on

H.R. 4715, The Technology Corporation of America Act

September 12, 1990

Mr. Chairman, Members of the Subcommittee on Science, Research and Technology:

Thank you for the invitation to testify today on H.R. 4715, legislation to create the Technology Corporation of America (TCA) as an industry-run government-chartered nonprofit corporation for research, development, and manufacturing activities in the strategic high technology sector.

My name is Thomas H. Stanton. I am a Washington, D.C. attorney whose practice includes a variety of matters relating to financial institutions and federal credit programs. A list of recent academic and professional publications on these topics is appended to testimony. I am speaking today only for myself and not for my law firm or any client.

These comments are necessarily general in nature. This subcommittee is to be commended for holding hearings at an early stage of the legislative process, to provide the opportunity for the Congress to address the financial and institutional issues that must be resolved before the TCA is proposed in final form.

I. Summary

My comments on the legislation can be summarized as follows:

1. Supporters of new federal programs must assure that they will be financially viable, and that they will provide maximum benefits per dollar of federal support. A disturbing number of federal credit programs today, ranging from the Guaranteed Student Loan Program to the Federal Housing Administration and the Farmer's Home Administration to Small Business Investment Companies, are in financial disarray.

2. The TCA can maximize its net benefits if it is designed to overcome what economists call market imperfections. A market imperfection is a problem, often caused by law or regulation, that prevents an efficient allocation of capital and other resources.

At the modest levels of funding contemplated by H.R. 4715, it is not appropriate to think of the TCA as providing credit assistance benefits that are familiar from other federal credit programs; TCA simply will not have enough money to buy down interest rates, or generally to provide loans with more attractive terms than market loans, for any significant number of companies or ventures. Moreover, any effort to provide credit assistance, without correction of market imperfections, runs a dual-risk: either that the assistance creates unacceptable levels of financial loss, or that the assistance merely displaces credit that would have been provided in comparable (not necessarily identical) form by private institutions even without federal involvement.

3. Assuming that a clear market imperfection has been found and analyzed, the TCA and its activities must be carefully designed to address that imperfection. In today's time of constrained federal resources, we must assure that each dollar of federal credit or expenditure, as the case may be, provides maximum public benefits. The limited amount of available federal resources is seen clearly in the modest $150 million level of funding authorized for the TCA under H.R. 4715, compared to the magnitude of reported credit needs of American high-technology ventures.

4. Once the federal program has been appropriately designed to achieve maximum public benefits, questions of institutional structure must be addressed to assure that the TCA has organizational capacity and proper incentives to carry out its public purposes. A threshold question is whether the TCA should be designed as a privately owned, privately-controlled corporation, or whether it should be a government agency. This choice should be made explicity. Misshapen federal corporations, ranging from the late Federal Asset Disposition Association and U.S. Synthetic Fuels Corporation to today's Resolution Trust Corporation and Resolution Trust Corporation Oversight Board, show the dangers of distorted incentives, and inadequate institutional capability that can result from faulty organizational design.

The current form of the TCA, as reflected in H.R. 4715, could use some revisions in this regard. My preliminary judgment is that the institution should be designed to be completely privately owned and should be structured to receive grants, loans, and other funding from governmental and private sources. Assuming that the TCA is to receive federally appropriated funds, the decision whether or not to provide these funds should be made by federal agency officials under legislative and regulatory guidelines, designed to structure their discretion to assure that the federal support will in fact help the TCA serve its public purpose of overcoming designated market imperfections.

II. A Framework For Institutional Design

While it is not possible to provide detailed comments on the bill at this stage of the legislative process, it may be possible to provide an analytic framework that, it is hoped, may be of use to the subcommittee and to the supporters of H.R. 4715. The framework can be presented as several questions and comments, in descending order of conceptual priority.

1. What are the problems that the TCA will help to overcome?

Some commentators point out that investor ownership and control of American companies results in excessive emphasis on short-term rather than long-term profitability. This means that investors may discount the value of high technology companies and penalize them for adopting long-term strategies.

Others argue that American companies would be more effective if they combined in consortia or other joint ventures that bring together companies with different financial, technological and economic strengths and knowledge. Here, the problem seems to be identified as one of insufficient breadth of perspective in the private sector, possibly again because of excessive emphasis on short-term results rather than upon accomplishment of longer-term goals according to a strategic plan. Key inquiries in each case are whether the marketplace by itself is in the process of overcoming the designated inefficiency, and -- if not -- why not.

2. Will the TCA in fact be able to overcome problems that have been identified?

Proposed solutions must be commensurate with the identified problems that they address. For example, it is not clear that the $150 million three-year authorization provided by H.R. 4715 would make much of a dent if the problem is a generally excessive short-term myopia among investors in our $5 trillion economy.

Supporters of the TCA need to avoid a fundamental dilemma that faces many federal credit programs: on the one hand, the funds may merely displace activities (e.g., commercial loans to high technology companies) that would have taken place anyway. Alternatively, some federal credit programs are designed to fund individuals or institutions that cannot receive commercial credit by themselves; such programs, unless carefully structured, may involve the prospect of considerable financial loss. The Farmers Home Administration and Guaranteed Student Loan Program come to mind here.[1]

Only when market imperfections are expressly identified, can one structure the TCA so that it has the greatest likelihood of overcoming those imperfections and serving public purposes with greatest effect and efficiency. If market imperfections exist, then there may be ways that the TCA could demonstrate innovative approaches or other benefits beyond the limited federal funding that is available. A number of federal programs have created positive demonstration effects:

- The Farm Credit System pioneered the provision of loans on a self-amortizing basis. Until the Federal Land Banks were established in 1916, farmers could only take out mortgages for a period of three to five years, at best, with principal due at the end of that time. The Federal Land Banks began making long-term loans, with maturities of between 20 and 40 years. The new self-amortizing loans, quite common today for a variety of loans and mortgages, permitted farm borrowers to make annual or semi-annual payments of principal along with the interest, to help gradually reduce the mortgage debt.
- The Farm Credit System also implemented early truth-in-lending policies, succeeded in reducing loan fees for consumers, and pioneered variable interest rate loans.

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[1] An excellent discussion of this issue is found in Elisabeth Holmes Rhyne, Small Business, Banks and SBA Loan Guarantees (Westport, Conn.: Greenwood Press, Inc., 1988). See especially Chapter 8, "Lessons for Design and Evaluation of Credit Programs."

- The Federal Housing Administration pioneered the long-term self-amortizing home mortgage.
- Ginnie Mae, the Government National Mortgage Association, developed the mortgage-backed security as an efficient funding mechanism that permits lenders to avoid significant interest rate risk.
- Activities of Fannie Mae, the Federal National Mortgage Association, and Freddie Mac, the Federal Home Loan Mortgage Corporation, have helped to foster a mortgage insurance industry, to provide a means to spread credit risk on conventional home mortgages, and also helped to promote the title insurance industry, to make home mortgages more easily marketable to secondary market purchasers.

While these examples are taken from large federal financial programs, other examples can be found in other areas. All of them represent innovations that proved profitable for other firms to use as well.

In designing a TCA to demonstrate financial or other innovations, supporters must identify private institutions that are likely to replicate the new products or processes, thereby amplifying the ultimate impact of the TCA activities. If one purpose of the TCA is to promote joint ventures by private corporations, this goal too should be analyzed to assure that demonstration effects are likely and that they can be replicated by other firms in other lines of business.

3. Assuming that the TCA is seen to provide important public benefits, should it be created as a corporation in the public sector or in the private sector?

Whether the TCA is created as a governmental agency, or as a privately owned and privately controlled corporation, lines of accountability and corporate incentives must be designed to promote accomplishment of the institution's public purposes.[2] Mixing of public and private characteristics in the same entity risks scrambling legal and institutional principles and thereby losing many of the benefits of either form of corporation.[3]

A. Conflicts-of-Interest

Consider a problem such as conflict-of-interest. In a government corporation that is a government agency, i.e., that is completely governmentally-owned and controlled, federal law prescribes the standards and procedures for dealing with conflicts-of-interest. In a privately-owned and privately-controlled corporation, conflicts-of-interest are addressed in law and in the common law duty of loyalty of corporate directors to the corporation that precludes use of their position for private gain, and their fiduciary responsibility to the corporation and its shareholders. There is a large and developed body of law and practice that helps to define the scope and nature of this duty and responsibility.

Use of a hybrid corporation, governed by a mixed board of private persons and government officials, risks that members of the board of directors may not be subject to clear conflict-of-interest requirements at all (except possibly those relating to extreme circumstances that are addressed by laws relating to fraud, for example).

B. Corporate Incentives

Even more important, consider the question of corporate incentives. The incentive structure of the private sector corporation is well-known. The investor-owned corporation is profit-oriented; directors have a fiduciary responsibility to act in the best interest of shareholders; and the competitive market provides considerable incentive to reduce costs and maximize profits if the institution is to survive.

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[2] The term "government corporation" is a catch-all that includes a variety of institutions ranging from completely governmentally-owned agencies to privately-owned and privately-controlled institutions. See e.g., Lloyd D. Musolf, "The Government-Corporation Tool: Permutations and Possibilities," in Lester M. Salamon, Ed., Beyond Privatizing: The Tools of Government Action, (Washington, D.C.: The Urban Institute Press, 1989).

[3] See, e.g., Ronald C. Moe, Congressional Research Service, "Privatization: An Overview from a Public Administration Perspective," pp. 66-67 (March 2, 1988), and "Exploring The Limits of Privatization," Public Administration Review (November/December 1987).

The federal government agency also has an incentive structure. The federal agency requires continuing appropriations of federal funds to survive, and must dedicate its efforts to serving designated constituencies. Federal officials are held accountable through federal government personnel policies and an array of statutory and regulatory requirements. Especially at a time of tight federal budgets, the agency has considerable incentive to elicit political support by maximizing the value of its services.

Admittedly, each of these institutional forms has drawbacks. Private corporations can become subject to short-term myopia, driven by the need to generate quarterly profits to satisfy shareholders insisting on short-term returns. Government agencies can develop cozy relationships with their authorizing subcommittees and powerful constituencies, resulting in the well-known iron triangle of bureacratic politics.

Even with their shortcomings, the two models do have clear incentive structures. The danger for a hybrid organization, selecting haphazardly from private and governmental characteristics, is that the institution may lose any incentive structure at all; the organization can merely drift without facing the competitive challenges either of the private market or of the federal budget process that would prompt innovation and dedication to accomplishment of clear goals.

In short, it is important that the TCA be developed to maximize the positive incentive structure of the corporation. Tentatively, I would suggest creation of the TCA as a completely private corporation, operating under a well-defined federal charter[4], authorized to sell stock and additionally capitalized with an initial federal grant. The corporation's board of directors would consist entirely of private persons with a fiduciary responsibility to the shareholders. The federal government would oversee the corporation through a designated federal agency authorized to make financial grants or loans under specified conditions. (H.R. 4715 specifies the Department of Commerce in this regard). While the corporation would make all decisions about the particular private companies or ventures eligible to receive its support, the federal government agency would judge the overall track record of the TCA and might even earmark funds for specified categories of activity, such as service to specified kinds of technology companies.

The TCA could be structured in a variety of other ways. What is important is to retain a clear division between the governmental functions and the private functions inherent in fulfilling the corporation's public purposes.

* * * * *

In conclusion, this subcommittee is to be commended for exploring the important issues concerning creation of the Technology Corporation of America at an early stage of the legislative process. Careful attention to the financial and institutional issues inherent in such legislation can help maximize the benefits and reduce the potential costs of this new federal endeavor. At a time when America's high technology companies face relentless international competition, sometimes backed by institutions of foreign governments, such careful consideration is especially important.

Thank you.

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[4] Here, I tentatively differ with the panel on government corporations of the National Academy of Public Administration; that panel, in a landmark 1981 Report on Government Corporations, recommended that all federally-chartered government corporations be structured as government agencies. This point deserves further deliberation.

V:SR09101:vrs

PUBLICATIONS ON FEDERAL CORPORATIONS AND FEDERAL CREDIT

by Thomas H. Stanton

"Government Sponsored Enterprises: Their Benefits and Costs as Instruments of Federal Policy," Banking Research Fund, Association of Reserve City Bankers, 1988.

"Government Sponsored Enterprises as Federal Instrumentalities: Reconciling Private Management with Public Accountability," Public Administration Review, July/August 1989 (Co-authored with Ronald C. Moe).

"Budgetary Consequences of Using a Government Sponsored Enterprise to Provide Financial Assistance to the Federal Savings and Loan Insurance Corporation," Public Budgeting & Finance, Autumn 1989.

"Federal Supervision of Safety and Soundness of Government Sponsored Enterprises," prepared for the Administrative Conference of the United States (Forthcoming).

"The Resolution Trust Corporation and the Assets of Failed Thrifts: The Local Government Perspective," Government Finance Review, April 1990 (Co-authored with John F. Petersen).

"Increasing the Accountability of Government Sponsored Enterprises: First Steps," Public Administration Review, September/October 1990.

September 12, 1990

Thomas H. Stanton

Thomas H. Stanton is a Washington, D.C. attorney with the law firm of Olwine, Connelly, Chase, O'Donnell & Weyher. His practice includes a range of matters relating to financial institutions and federal credit programs. Mr. Stanton serves on the Standing Panel on Executive Organization and Management of the National Academy of Public Administration (NAPA). He is a speaker and resource person at the annual NAPA seminar on government corporations. Mr. Stanton has also been invited to provide testimony to a number of congressional committees concerning financial institution and federal credit matters. His writings have appeared in *Public Administration Review*, *Public Budgeting and Finance*, *Government Finance Review*, *The Office of Thrift Supervision Journal*, and other academic and professional journals.

Mr. VALENTINE. Thank you, sir.

Mr. Stern?

Mr. STERN. Thank you, Mr. Chairman. I want to thank you for the invitation to appear here, not only in the company of the colleagues on the subcommittee and on the full committee, but also my colleagues here at the table, because I think that we are addressing one of the most serious issues that the United States faces.

Mr. Elkus has very eloquently expressed the danger that we, obviously, see in connection with the oil problem, but the other problem that we do not obviously see, which has to do with technology.

What I'd like to do, if I may, is have my statement entered into the record. If I may, I also have as an appendix, a report that Dr. Edelson and I wrote in 1989 dealing with the operations of DARPA in the Defense Department, and the possible utility of that agency as a model for a civilian advanced research projects agency. We raise some questions there about how one would implement it. And the questions of implementation there are, as a matter of fact, the same questions as the questions of implementation with regard to the Technology Corporation of America.

I'd like to stress some things that are mentioned in my testimony, and in particular I think the currently unrecognized problem that not only do we not have consensus from this Administration that something should be done about support for generic technologies, but we also do not have consensus in industry that there is a Federal role to be played in technology development. As I state, and I do this in my own right rather than based on any survey, I think that if today you asked the National Association of Manufacturers, the Chamber of Commerce of the United States, the Committee for Economic Development, and other industry-based groups, let's say like the Business Roundtable, to tell us whether they would favor Federal Government entry into the development of generic technologies, I do not believe you would get the consensus to say yes, in spite of the threat presented so eloquently by Mr. Elkus.

Mr. VALENTINE. Let me interrupt you to say we don't have to guess at what the Chamber of Commerce would say.

Mr. STERN. That's right. Well, it's unfortunate that one, you see, doesn't have to guess. I consider that very unfortunate. Because Ira Magaziner points out in his testimony what is actually happening in the marketplace. In other words, we are the world's source for practical, commercializable technology, but the United States is not the one that is capturing the benefits.

As another element I think in my testimony, I'd like to stress the fact that we as a nation, we have not yet decided as a nation that we shall compete. Japan made that decision decades ago. It decided that as a nation it would compete. The European Economic Community made up its mind about that some 10 years ago. There were some fumbling early efforts, but the clumsiness is kind of out of it now. The programs have been exercised. People laughed at first about EUREKA, BRITE, RACE, and JESSI. Who's laughing now? They're actually getting results.

They have honed a mechanism whereby their governments, their corporations, their universities, and their national laboratories are working together on problems and issues that will generate income for the European Community. It's amazing to have done that in an environment where so many different languages are spoken. We don't have that problem here. I do understand, of course, the Chairman may have certain difficulties understanding us Northerners, and we may have similar difficulties in the other direction. But those are really minor compared to understanding Italian, Spanish, French, English and German, and they have done that.

So, it would appear that the only significant industrialized bloc that has not come to the conclusion that it must compete internationally is the United States. I'm excluding for the time being consideration of the Soviet Union and China because of the great difficulties right now in assessing what's going on there. But, if we stick with the three principal groups, two have made it very clear what their strategy is, and they have made it very clear how they respond to the demand of technology, which, as Mr. Elkus pointed out, is very capital intensive. We haven't made up our minds about that.

Now, perhaps the United States figures we can afford it. We have been able to afford this sort of thing in the past. When we were the dominant economic force in the Western world, from let's say the end of World War II to let's say the 1960s, we essentially not only could afford it, but it was important to us to create an interdependent world that had some compatible standard of living with our own. We've done that. Now this other part of the world is about to pass us by. They're about to exceed us. Their standard of living is likely to get higher than ours. Now what do we do?

Currently, as I say, we have an Administration that has clearly come out against "industrial policy," and, while it has not explicitly said so, I would think that Mr. Levine's bill for the Technology Corporation of America might be thought to be part of an industrial policy, and hence might not sit too well with the White House. We don't know that explicitly.

But the one part of a coherent technology policy in this area that the Administration has found permissible is the creation and the funding of the Advanced Technology Program. It's funded at the $10 million level; we all know that. There are various proposals to have it be funded at much larger levels, in the hundred million dollar class and up. My own suggestion is that it is so important that ATP be done right that it should grow relatively slowly to the hundred million dollar level. Fortunately, it is being administered by as good an agency as you could possibly find in the Federal Government, and, in fact, as good an agency as I think you could find in the private sector to do what it is chartered to do.

So we have an experiment that is going on here that is apparently below the threshold of attention of the White House people who oppose "industrial policy." It's done by a good agency. They're getting plenty of proposals in, I understand. The closing date for receipt of proposals is September 24. The NIST is well organized to screen the proposals and possibly make awards before the end of the year. So I'd like to just stress the importance of that particular experiment that's going on right now. In fact, the only experiment in town.

What somehow has to be done, though, the larger question I think is how to have industry recognize its self-interest in this competitive technological race, because at this time I cannot identify a trade association or a discussion group or any other roundtable in the industrial circles that would come out and support Federal activity in the technology policy area. I think that's the biggest challenge before us, and I would hope that this committee, and particularly this subcommittee, would continue its probing into how to bring that consensus about. In this instance the Congress is clearly ahead of the Administration, and the industry is farther behind than the Administration.

So, I'm sorry to end on a negative note of this kind. I hope it is not taken as a negative note, but rather as a challenge to continue the good work that this subcommittee has sponsored and that creative ideas such as that of the Technology Corporation of America make us all think about.

Thank you very much, Mr. Chairman.

[The prepared statement of Mr. Stern follows:]

TESTIMONY OF

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ON H.R. 4715

THE TECHNOLOGY CORPORATION AMERICA ACT OF 1990

BEFORE THE

SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY,

HOUSE COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

SEPTEMBER 12, 1990

CHAIRMAN TIM VALENTINE AND MEMBERS OF THE SUBCOMMITTEE ON SCIENCE, RESEARCH AND TECHNOLOGY, HOUSE COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY:

My name is Robert L. Stern. For the past 10 years, I have been an independent consultant on technology management, based in Washington, working on projects for private sector and public sector clients. For an even longer period, I have been a participant in and observer of the evolution of U.S. national technology policy.

In 1989, I co-authored with Dr. Burton I. Edelson of the Johns Hopkins Foreign Policy Institute, a report for the Carnegie Commission on Science, Technology and Government; we examined the effectiveness of the Defense Advanced Projects Agency of the Department of Defense in developing dual-use technologies and considered the applicability of that agency's practices to a proposed civilian advanced projects agency. In 1988, I co-chaired with Dr. Christopher Hill, the Engineering Foundation's week-long conference on technology policy during which a diverse group of about six dozen engineers, lawyers, economists, scientists, engineers and policy analysts tried to define the functions and operating procedures for a hypothetical U.S. federal technology agency. Dr. Hill, then of the Congressional Research Service's Science Policy Division, is now the Director of the National Academy of Engineering's new Manufacturing Forum.

Way back in 1962, at the Department of Commerce, I served as Special Assistant to the first incumbent Assistant Secretary for Science and Technology, Dr. J. Herbert Holloman, then recently from the General Electric Company's Research Laboratories management. I became responsible for a new and now almost forgotten program, the Civilian Industrial Technology Program, funded at $1,000,000 in the first year and at $625,000 in its second, and terminal year. Later in this hearing, if there is time, we could talk more about that brief experiment; many lessons may be learned from it, still applicable today.

These fragments of technology policy history are recounted here today to highlight that many proposals have come (and also gone), over nearly a thirty-year period, all of which were intended to help America be and remain a strong, technologically-competent competitor in the world's market place; and yet, we seem to be losing more ground in that arena.

To turn directly to the subject of this hearing, Congressman Mel Levine of California and his growing number of co-sponsors are to be complimented for presenting for consideration their imaginative Bill, H.R. 4715: it intends to bring to the competitive marketplace the fruits of exploiting strategic technologies; this is to be done by bringing new forms of encouragement, through government-industry collaboration, to research, development, manufacturing and other activities associated with the use of strategic technologies. The proposed Technology Corporation of America is the instrument chosen to carry out the far-reaching provisions of H.R. 4715. The concept of such an industry-run, Government chartered, non-profit corporation is, on the face of it, an attractive formulation with many desirable features. However, as I see it, much remains to be done before that concept and its implementation could (and even should) be accepted.

First, NO CONSENSUS HAS YET DEVELOPED in the U.S. -- either in industry or in our government -- that the federal government has an acceptable role to play in the development of generic technologies that have linkages to future commercial, private-sector objectives.

By constrast, it has long been accepted -- in both the public and private sector -- essentially since the end of World War II -- that science is a legitimate recipient of public funds; this is exemplified by federal agency budgets, expended in the form of research grants and contracts, by the National Science Foundation, the National Institutes of Health, the Department of Energy's Office of Basic Energy Sciences, as well as the "science" portions of the budgets of the Departments of Defense and Agriculture and those of a few other agencies.

With regard to technology, to date, only the Department of Defense has been consistently empowered to develop technology -- for national security purposes -- even though the same technologies have with some reasonable frequency been found to have dual uses, i.e. civilian as well as military uses.

Whenever Departments other than Defense have advanced proposals for technology funding (Commerce, Energy, Housing and Urban Development, Transportation -- and each have done so in the past three decades) various branches of industry, trade associations or other special interests have raised objections; the objections center on the premise that such use of federal revenues or powers is counter-productive and potentially wasteful in a free market economy like ours, built on private, decentralized, entrepreneurial investment decisions. Furthermore, as soon as one enters the territory of federal technology funding, the dismaying story of the U.S. experience with the synthetic fuels program and its Government Corporation rears its head, further clouding the issue.

Today, if you tried to get endorsement for use of federal funds for technology development outside of DOD, say for example from the National Association of Manufacturers or from the U.S. Chamber of Commerce or from the Committee for Economic Development, you would not obtain it! Furthermore, the current Administration has repeatedly stated that it opposes what it labels an "industrial policy" (See, for example, the 1990 Annual Report of the Council of Economic Advisers, transmitted to the President on February 1, 1990 -- pages 116-117); the term, "industrial policy", as undefined as it is, most likely encompasses H.R. 4715 even though no specific reaction to this Bill has yet been voiced by the White House.

I would also point out that certain provisions of H.R. 4715 tread on ground that has recently become particularly politically sensitive; I refer to the Bill's provisions for the use of government funds to lower the cost of capital and the implied changed (improved) conditions for strategic-technology venture capital investments.

No one knows for sure, but it would seem that the first use made by Dr. Craig Fields, Director of DOD/DARPA of his agency's newly won authority to put government capital into small, high-tech and strategically important companies, precipitated his "reassignment" on April 20, 1990. This "reassignment" occured swiftly and with little explanation, even though the authority used was approved by the Congress and was incorporated in an Administration-signed Executive Order. It should be said that Dr. Fields, during his first year in office as head of DARPA, had been one of the most adventuresome and imaginative users of DOD's implied mandate to continue to develop dual-use technologies, as DARPA had consistentlly done during the agency's entire post-Sputnik life. Dr. Fields should be commended for his devoted pursuit of what he believed (along with many others) was and is in the national interest. The country is fortunate that his services continue to be available, currently as President of the Microelectronics and Computer Corporation, MCC, the Austin, Texas based consortium.

While it is not officially part of H.R. 4715, the background paper for the Bill states that the Technology Corporation of America would be modeled, in part, on the Radio Corporation of America. The latter was set up in 1919, as part of a consortium in conjunction with the U.S. Navy, to pool communications related U.S. patents and exploit them in competion British firms which had a commanding lead in the world markets of that day. I would like to note that the RCA model is not ideal today, and did not turn out to be totally salutary in the interim; the anti-trust suits against RCA in 1929 and again in the 1950s should be considered especially in the latter period, when it was claimed that RCA spin-offs such as Philco and Zenith were squelching the entry of smaller and newer-technology based firms in to the U.S. and overseas markets.

In spite of current obstacles, it is most important to our country that the exploration of an acceptable federal technology policies be continued, with an eye towards ultimately making mechanisms such as those proposed in H.R. 4715 viable.

If we look at developments by other governments around the world, aimed at their enlightened self-interests, it becomes essentially imperative that the U.S. responds appropriately and differently than it has in the past.

The long record that Japan has now established in organizing its private sector together with its banks and government to work colloboratively to obtain growing world shares of markets for high-technology products shows us one road to success. That particular approach is not culturally practical for the United States, but its viability and effect will be well documented here by another witness, Mr. Richard J. Elkus, Jr. of PROMETRIX.

The growing experience of the member countries in the European Community, through such multi-billion dollar projects as EUREKA, BRITE, RACE, JESSI etc., funded jointly by government and industry, has taught its members how to bring economies of scale into technogy-based ventures that are too large for any one country, one company or one research laboratory. The joint venture mechanisms and the new modes of collaboration across countries, companies, universities, languages and market organizations are breaking profitable ground that will make the new Europe a tough competitor for us and for Japan. We must carry out similar experiments, especially in areas where the strategic technology to be exploited demands capital and time horizons beyond the resources of even the biggest U.S. based multinational companies. A good example is X-ray lithography, where even IBM has declared that it cannot alone fund its commercial development. Experiments, such as the one envisioned in H.R. 4715 must soon be conducted, to find out :

WHAT WILL WORK FOR THE U.S. IN THE NEW GLOBAL MARKET ERA.

For now, one experiment has been permitted by both the Congress and the Administration. It is the $10,000,000 Advanced Technology Program (ATP) of the Department of Commerce, operated by the National Institute of Standards and Technology (NIST). The first set of proposals under ATP are currently being received, with a deadline of September 24, and with first awards expected later this year.

The ATP experiment is in good hands at NIST, within the Department of Commerce's Technology Administration. LET'S SUPPORT THE SOUND CONDUCT OF THAT EXPERIMENT. One last word: since ATP has become the "only game in town", zealous supporters have offered legislative proposals that it be built up quickly into the multi-hundred million dollar budget range. I see a danger in this: too fast a build-up can result in lower quality awards; possibly worse, large budget requests can attract too much attention from those who still question the wisdom of a government role in U. S. civilian technology development. Let's learn what is right for the U.S., quietly and carefully before we take on the problems of scaling up.

Mr. Chairman, I stand ready to answer questions that you or the other Members may have; thank you for the opportunity to express my views on this vital topic.

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Mr. Stern is a chemical engineer, trained at M.I.T., who subsequently took advanced management courses at Stanford University. For the past ten years, he has been an independent consultant to private and public sector clients, including IBM Corporation, Marion Laboratories, the Consultants International Group, the Council on Competitiveness, the Carnegie Commission, General Accounting Office, and the National Science Foundation.

The tasks performed for clients include the evaluation of management effectiveness at government and private laboratories, market research on new high-technology products, assessment of federal programs aimed at stimulating technological innovation and policies for technology transfer; other roles have been monitoring the development of national technology policy and improving the access of the private sector to technology sponsored or performed by government agencies.

In 1989, Mr. Stern co-authored a study of the effectiveness of the Defense Advanced Research Projects Agency in developing technologies useful in military systems as well as for the civilian industrial base; this was a timely input to the on-going debates about the government's responsibility for domestic technology adequacy outside the defense sector. In 1988, he was co-chairman of the Engineering Foundation's week-long conference aiming to outline the vital functions and operating policies for a model federal technology agency.

After a dozen years' experience in chemical process design and commercial market development with Stauffer Chemical Company, Arthur D. Little, Inc. and Bolt Beranek and Newman, Mr. Stern first became involved with federal technology policy in 1962; he became Special Assistant to Assistant Secretary of Commerce for Science and Technology, Dr. J. Herbert Hollomon of the General Electric Company and managed the Civilian Industrial Technology Program. Subsequently, he was Director of the Office of Industrial Services at the National Bureau of Standards and then Assistant Secretary at the newly-established National Academy of Engineering.

His career, after leaving government, includes positions at Xerox Corporation's corporate headquarters where he served as Assistant to the Senior Vice President R&D (Dr. J.E. Goldman) and the Conference Board in Washington DC, where he served as Director of Business/ Government Relations. Mr. Stern is Secretary of the Indusirial Science Section of the American Association for the Advancement of Science and was elected Fellow in 1978.

4/90

Mr. VALENTINE. Thank you very much all of you. I feel—we've had such a frank conversation I think we ought to recess and everybody go take a cold shower, and come back and go at it again.

Let me before I recognize our colleague, Mrs. Morella, who has joined us here, to just kind of ramble around a little bit and give you some, maybe some insight into what the problem looks like from this side of the counter, and also, for one who has been lately to—has come lately to this responsibility. I in my other life was going straight, as we say, for a long time before I decided to run for Congress, and also was involved entirely in a field different from what I find myself in now. I was a country lawyer.

And, with this responsibility and others that have come to me in this place, the refrain that I hear more than any others is what you say here today: that our country in areas of, if not manufacturing, in research and development, is it not, depending on who you're speaking to, in a time of decline or on the slippery slope to oblivion? And the solution seems to be in one way or another how do we get more money out of the Federal Government to do things that have to be done. That might be the answer to the problem. It probably is in one form or another. But it becomes the responsibility of the Congress at a time when we are tasting the bitter whirlwind which has resulted from the Government assuming more responsibilities in this area and that area, starting out with a $10,000 insurance policy for every Aunt Jane and Uncle Robert who put money in a savings and loan, and that was increased—what?—to 40,000, and one dark night or early one morning we all looked around and it was $100,000 on every account that anybody wanted to contrive, which has been responsible for leading us to what will be the worst—what is the worst disaster ever to befall a country outside of a great depression or a war.

And we start out with the Farmers Home Administration to make it—to keep little farmers on the farm, and we make money available. When I was practicing law, why they would loan—we'd scratch our heads and say, "How can you loan this guy this money?" You want him to take $100,000 in his farm and all his equipment isn't worth but fifty. But we go on with it and its a disaster in that area.

And I don't know, I would love Mr. Elkus to talk to us a little bit more about his statement, so that I can understand it as a layman a little bit better. There are many of us who wonder about a situation where we are with our troops defending the oil supply, which is the lifeblood of the whole world, and there seems to be nobody else at risk but us. And, while we keep open the pipeline, the transfusion, the flow of blood, it's—you know, we seem to be the only one that's doing it, and these people that are overseas in Japan and Germany that are literally beating our brains out are able to take money that we spend on national defense and put it in research and development.

So, you know, how the heck do we change that unless we just stop and demand a reshuffle, and probably it has gone too far for that. We search here for ways to address the problem, and we face the frustrations that you do. I mean, we don't have any corner on the market. My God, I know you know more about it up close.

But is there any solution to what we're talking about other than the Federal Government putting billions and billions of dollars into research and development? Is there any other solution? Mr. Elkus?

Mr. **Elkus**. It's my belief that government putting billions of dollars into research and development will not work and is not a solution.

Mr. **Valentine**. Well, then—

Mr. **Elkus**. I want to make it very clear and then I'll come to an answer.

Mr. **Valentine**. All right.

Mr. **Elkus**. The problem is so large and the cost of what we have to do, in my estimation, is so great that the idea of the Federal Government coming up with funds to redo an industry is impossible. It won't work. There's only one way that you can get back, in my estimation, to something that gives you a semblance of competitiveness in terms of being able to participate in these end-use markets. And I want to comment a little bit later on, if you give me a chance, on, you know, why we pay versus somebody else paying for the troops over there.

The key to research and development is not only generating funds, but also knowing how to spend those funds, what is required and exactly what you want to get out of it. Now, you can get research in lots of different ways. You can spend lots of money in research and come up with a product which may or may not fit any market. You can buy a little company that has already done all of the research and couldn't quite make it, and you get it for pennies on the dollar. You can take a license to research. Research means nothing unless it can be implemented in some way in a viable product. It means nothing. Okay?

Now, let me give you a case in point, and I'm going to come to the—to answer your question. Many years ago, there was a guy by the name of Oshinsky and he came up along at UCLA, our laboratories at UCLA, with a product called amorphous silicon. Amorphous silicon is a solar cell. You know what that is. Now, when they came up with that they tried to get a U.S. company someplace to take a license to it and implement it. So lots of U.S. companies looked at it. But they couldn't get enough electricity out of that stuff to really make it effective, so they backed off, and no U.S. company got involved at that time in any meaningful way.

But there was a little company by the name of Sharp that had a little card calculator. Didn't require any power at all. And they came over and they took a license to amorphous silicon invented in the United States. And they began to work on that and pretty soon as they produced millions and millions of these little card calculators they found that their ability to improve that—the efficiency of that product to the point it was effective so that it could run radios and television sets.

Now, for all of us, and I've told this story before, in the United States those little radios and television sets, and little calculators, are kind of fun. Put them in your pocket, play games. You can go sit at the football game and you can watch one thing and listen to another. But that ain't the point.

First, if you're in China or in Poland—and I was just there on a trade mission, met with the top leaders of Poland—if you're in the

Eastern Bloc countries or in the Third World nations across the board, what do you need? You need telecommunications equipment, very low cost, easy to operate, never requires any service, doesn't require any spare parts, doesn't require any batteries, doesn't require any wires or anything like that, never breaks down, very low price. That's exactly what these guys developed.

So what happens? All of a sudden they begin an infrastructure in Third World countries and in China that we can't even match. When I was in Poland, you don't see any American products. You only see Japanese signs and European signs, particularly Sony, Mitsubishi, companies like that. When I talked to the president about foreign investment there, and the Secretary of State and other people along those lines, their comment was, "We want to do business with you but you don't make any products that we need, that we can use."

Now, let me add something else to this comment about amorphous silicon. This lousy little calculator developed this huge market that pushed the technology along for amorphous silicon that allowed for television sets, radios, calculators, and whatever. But now something else begins to creep on the horizon, way over in the right-hand side. It's called high-definition products. Let me explain—

Mr. VALENTINE. Let me ask you right here—excuse me.

Mr. ELKUS. Yes.

Mr. VALENTINE. Just put your finger right there. Up to this point, though, aren't you talking about poor business judgment?

Mr. ELKUS. No. No. In the United States of America, and this was absolutely promulgated by the Boston consulting group, it was absolutely indigenous to every business school in the country, it still is taught in most business schools in one form or another. There is a concept that says that if you can't make as much money in this area as you can make in this area then you withdraw your funds from this area. You sell it off, close it down, reorganize it, and you put your money where you can make more money.

So, for example, General Electric sells RCA to SGS Thompson so that they can invest more money in areas where there is a much higher growth margin, in medical electronics. But, if I am correct—and believe me, I am—the products and markets as they are pushed to their logical extreme become interrelated pretty soon you find two things happening.

Number one, the products that you thought were dog businesses, that you got out of because you couldn't make enough money, become absolutely essential to the markets that you are in. So, for example, RCA represents or represented at that time the largest single company manufacturing displays—television sets—for the United States and, in fact, the world. When that went a major remaining portion of our ability to develop displays in this country went with it.

Now, if you're General Electric in the medical instrumentation business you are making a lot of money today. But you are using semiconductors which come from the markets promulgated by RCA. You are using displays which come from the markets promulgated by RCA. The bulk of those markets and the technologies that support them now reside in Japan, and to a lesser extent in

Europe, not the United States. So IBM goes to Toshiba for its flat-screen display.

The point I was going to make with this little, this thing called amorphous silicon, who would have guessed—and I want to give a comment to you that Morita gave to me shortly on this point. Who would have guessed when they came out with amorphous silicon and somebody fudged around with a card calculator, which, I might add, we weren't in because little calculators were tough to make, to make any money on at all. Okay? Who would have guessed that? That amorphous silicon is now a fundamental approach to manufacturing flat-screen display, which will be essential for the entire computer industry, essential for the home television market, essential for the video tape recorder market, essential for the whole concept of multimedia and telecommunications across the board.

The point I'm making is this. We got one shot. We have several markets where we still are pre-eminent. We're pre-eminent in the computer business. We have many legs into the telecommunications business. And we certainly have a hell of a capability in software and media at large. And, by the way, when I say media I want you to understand that I'm not talking about software for computers only. I'm talking about mass media including newspapers, televisions, movies—all of those things. Okay? We have strong positions in those markets. We have strong positions in the chemical industry. We have some positions left in biotechnology, but it's going quick.

We can utilize those markets and leverage off those markets to get back into markets that we are—that we want to get into. The first thing we have to do is that the President of the United States, coupled through bills and things that we're talking about here, has to convey to the public at large and everybody in it that walking away from products and markets is fundamentally unhealthy for the United States of America, if you're doing it on the basis of opportunity cost.

Number two, we have to begin to commune together to discuss methods whereby we can use our ingenuity, the leverage of the markets that we've got left to get back into the markets that we've walked away from.

I'll tell you a little story to make my point. Gillette was having a devil of a time, I think, with Bic and their razor. You know, their discardable razors. And Bic and their discardable razors was eating up the market. Gillette couldn't figure out how to stop it. It was causing them a tremendous pain. But, you remember the Bic pencil? Well, Gillette had an activity—and I can't remember what it was—in that same area. So they used the Gillette effort in the pencil area to make it very difficult, pricewise and otherwise, for Bic to do an effective job in their pencil business. It took the heat off the razor blades in a flash and Gillette was back in business.

Mr. VALENTINE. Yes.

Mr. ELKUS. What I'm trying to say is this. We've got to be able between government and industry to take what we've got, develop joint ventures with companies in other countries—for example, Japan—who are in the areas that we want to be in; get them to develop those joint ventures on our soil, using R&D efforts promulgated in this country—

Mr. **Valentine**. But how does the government do that if it doesn't put money in it?

Mr. **Elkus**. Oh. Lot of ways. All kinds of ways. For example, the government could say—and, remember, I'm just thinking out loud here. I'm not trying to push any particular approach. But access to market. Access to market. Depending upon negotiations that could go on, access to market could be dependent, for example, on the willingness of certain companies in a given country to put a joint venture together here with a U.S. company—having nothing to do with the fact that they could continue on to ship their own. There are many, many ways in which U.S. companies with the help of the government can in fact provide some incentive for that—for the foreign government and the foreign companies to work in conjunction with U.S. companies here on a joint venture basis.

Mr. **Valentine**. Well, if that is not, if that's not an infusion of money, that is a restriction on trade is what you're talking about now, isn't it?

Mr. **Elkus**. It can be a restriction on trade, certainly. You can also indicate in various ways that we would be more willing to accept this in a—we are constantly in trade negotiations with foreign governments. Okay? In the give and take of those negotiations one of the things that we can put on the bargaining table is we're willing to give up this in order to ask that X companies in such field do something in joint venture with us.

The point I'm trying to make is that you've got to get there with the markets and products we've got. You can't just infuse money in it and get something.

Mr. **Magaziner**. Mr. Chairman, if I—

Mr. **Valentine**. Yes. Let me ask you—I do want to recognize Mr. Magaziner and these others, but let me just make one comment if I can.

The story that you told about the person who developed the chip, there is no way that the President or the government would have influenced that arrangement. Is there?

Mr. **Elkus**. Yes, there is. And we've already done it. Okay. Now, let me—

Mr. **Valentine**. I mean could have changed what you said. He made a—this chip was invented. It was one company made a decision, we will take a chance on it, we will make the little computer. The government couldn't have influenced that, could they?

Mr. **Elkus**. There is a company called Perkin-Elmer. Perkin-Elmer today has a product which, if it is fully developed, will become a pre-eminent level of technology in what they call the stepper field, which is important to the semiconductor industry. IBM had placed an order for $100 million worth of this equipment. IBM and others effectively came to the government and others and they all talked about it, and they said: Look. Perkin-Elmer wants to sell this to Nikon. Sell this entity to Nikon. Nikon today is the largest manufacturer of semiconductor equipment in the world. It's two-thirds of their business; only one-third is cameras. It was finally decided that this business would not be sold to Japan because its technology and products were too strategically important. And so a deal was done with SVG and IBM and the seller, Perkin-Elmer, to establish a relationship within the United States to ensure that it remained here.

Mr. VALENTINE. Yes. But the story that you told, nobody realized that this little chip had any special value.

Mr. Magaziner?

Mr. MAGAZINER. I want to, I agree directionally with what Mr. Elkus is saying but I'd like to say it in a couple of different ways. First of all, in the amorphous silicon chip issue that you're raising, or that he raised. I mean, we had a solar energy program funded by the government, which back in the early 1980s, in fact, funded Oshinsky and also was funding a number of companies who began to work on developing products and demonstration projects and so on, a couple of which involved amorphous silicon. The Japanese actually copied our program, something they call Project Sunshine, and set up a National Energy Development Office in 1979. We had started our program in '77. And that government program in Japan helped form some of the consortia that pushed forward their research.

We diminished our program, in the early 1980s, significantly—eventually it got put back by about 80 percent—and most of those companies who were putting up 50 percent at least of the money themselves then pulled back. And, in fact, Oshinsky eventually wound up with Arco Solar, I think, which is now eventually sold to the French.

But I think government involvement at the time had made some difference, but then we pulled back, and that was something we did somewhat uniquely.

But to get to the more general point, I agree with Mr. Elkus—and I'm not sure I understood one thing he was saying—that just putting money towards R&D in itself doesn't get you where we need to get strategically. My own view is that it can be an important role as an incentive. And I was part of the discussions going on in Europe in the late 1970s when they were—and the early '80s—figuring how to counter the Japanese challenge and part of the group that was involved in helping form the European Business Roundtable and some of the efforts that then went on from there to counter that challenge, and they considered a whole variety of strategic responses which involved managing market access, as Mr. Elkus has suggested, but also involved providing these incentives to R&D and a range of other things to make sure that Europe would be present in strategic industries that they had fallen behind on.

And I think the most important to me in what Mr. Elkus is saying is that they recognize something they used to call key linkage industries either as a supplier linkage or as a user linkage. And that is, that in certain areas, whether it was semiconductors or whether it's steel or whether it's on the supplier side or whether on the user side, it's things like aircraft, commercial jet aircraft, or whether it's computers or whether it's consumer electronics, you have key industries that are users or suppliers that are linked together with a whole series of other industries. And, if you go out of a whole series of those industries as a nation or become very diminished in them, it has a domino effect on a whole series of other capabilities that you can muster.

Mr. Valentine. Well, did that linkage, so-called, occur as a result of business cooperation or the government? Did the government make them do it?

Mr. Magaziner. Well, I think the concern has to be on the part ultimately of the government for the national effect. Because, as Mr. Elkus pointed out, an individual company can say to itself: Look. I don't need to be in this, that or the other thing as long as I've got a couple of things that I'm dominating or I can make money in. I don't need to be in everything. But what happens is that—

Mr. Valentine. How does the government get them into these places unless it subsidizes them?

Mr. Magaziner. Well, I think it has to be incentives. And that's why, you know, I'm not sure whether Mr. Elkus thinks the incentives don't play any role. I think what I understood him to say is they don't play a sufficient role, which I would agree with.

But especially—and this is the final point I want to make—when you're in a world, if all of us were operating in Adam Smith's world, and the Japanese and Europeans weren't thinking these ways, okay, then one might be able to make an argument, let's give that a try. But when you're competing against people who are basically saying, I'm going to have every key user industry and key component industry present in Europe or in Japan as a matter of national government policy, which is the reality—okay, that's the reality of government policy, the discussions that are held between government and industry all the time discussing these things, and when industry has problems with, you know, I'm not sure we can do this or that or stay competitive, then they enter into a dialogue and the government gets involved in discussions. When that's the world that you're competing in, if you're not playing that way you don't have a chance.

Mr. Valentine. Well, how do you compete in that world if you are a government that has to defend everybody? If you have to spend billions and billions and uncounted billions to defend your adversary, Japan; to defend your adversary, Germany?

Mr. Magaziner. Well, I, I agree with you about that.

Mr. Valentine. Yes. Excuse me. Mr. Stern?

Mr. Stern. Mr. Chairman, as I mentioned in my testimony, I have been an observer of the technology policy scene here in Washington for about 30 years. It's both good and bad to have three decades of vision about what has happened in the United States in technology policy.

I came here first to serve in the Kennedy Administration, at the Commerce Department, at a time when we had a Science Adviser who had a very clear vision about the challenge, the scientific and technological challenge to the United States. Today, I'm afraid that the position of the Science Adviser, although it's now called Science and Technology Adviser, has been eroded in terms of the access that he has to the President of the United States, even though he is a very qualified and distinguished individual.

In my examination of the issue of technology policy for the United States I come to the unfortunate conclusion that the only place from which leadership can come to follow out some of the ideas that Ira Magaziner and Dick Elkus and Mr. Stanton have expressed this afternoon, and that Congressman Ritter and Congressman Levine started us off on, is the United States Congress. The leadership will not come from this Administration.

And the leadership also is unlikely at this time, without some additional discussion, to come from industry. I only know of one industry group at this time that is seriously considering technological alternatives for its future, and that is the newly formed Computer Systems Policy Project, which is led by companies such as Apple, Digital Equipment, Hewlett-Packard, and IBM. There are I think 11 member companies now. They met for the very first time in January of 1990. It was the first time that 7 chief executive officers of U.S.-based computer companies were in the same room. Many had heard of each other through articles in Fortune magazine, but they had not met. They had had not had a place to discuss what their common objectives are as well as what their competitive objectives are.

So I see the need for more places where discussion can be held of the type that is being held this afternoon, and of the type that is stimulated by Congressman Levine's bill, and by your hearings, Mr. Chairman. Because I don't see any other site for it.

And these lessons are hard to learn. First, the analysis took quite a while. Now, I think we know what the rest of the world is doing. We understand the European directions and the European accomplishments. We understand the Japanese accomplishments, and we welcome, in a sense, the competition and the fact that we're all at a roughly similar standard of living.

But can the United States continue to work on essentially its free enterprise, totally entrepreneurially driven system without a sense of common direction practices? Is leadership likely to come from our Treasury Department to solve this? Is leadership likely to come from our Defense Department? From our Commerce Department? From our Energy Department? From our Agriculture Department? I would say no, under the present circumstances. Is it likely to come from the White House? I would say no. So it seems to me that's the good thing about having three branches of government. This time the Congress is in the lead and I would hope—

Mr. VALENTINE. Excuse me, sir. If you're going to say anything good about Congress, I'd like to get somebody else in here to take it down because—

Mr. STERN. Well, I—

[Laughter.]

Mr. VALENTINE. —we hear it so seldom. Can we send out and get other people to come in and hear this?

Mr. STERN. Yes. Unfortunately, that is true, Mr. Chairman. But your record is definitely improving.

[Laughter.]

Mr. VALENTINE. And you're going to take part of it back.

Mr. ELKUS. Can I make—

Mr. VALENTINE. I'm told we're going to start having votes and I—let me ask Mr. Levine if he would—would you like to make any further contribution? I was going to ask these gentlemen if they would tell us in a word or two how they would change the legislation to solve all the problems they have told us.

Mr. LEVINE. No. I am just here to listen, Mr. Chairman.

Mr. Valentine. Certainly my words today come from frustration, and maybe yours do too. You know, we want to do something. We want to correct some of these problems. But I have to say again that some think in dealings with the White House that that operation over there, at least insofar as competitiveness is concerned and the need to lead is in deep Sununu. But maybe that will change.

Mr. Stanton, do you have anything you would like to add? Mr. Elkus had raised his hand. I find this very helpful, illuminating and stimulating.

Mr. Stanton. Mr. Chairman, I guess I would go back to one of the suggestions in my written testimony, which is that the Technology Corporation of America might usefully be structured as a completely private, profit-motivated—not completely profit-driven, but profit-motivated institution working very closely, for example, with NIST, with a government agency.

The one point I would like to stress. We hear a lot of calls for joint government-private sector partnerships. The experience in the United States, it could be because of our political culture, who knows what, has not been very good. There is a whole body of literature, and I'd be delighted to share these insights and background with staff later, dealing, for example, with the difficulties of putting Presidentially appointed members on public boards. We've had problems with that dating back to the Second Bank of the United States.

I respectfully suggest that something like the Technology Corporation of America might better be left to select its own board, and to evolve over time. If you need people with engineering background or finance background, the leadership of that Corporation will be able to pull those directors in as is appropriate. The government on the governmental side can judge the Corporation and its track record in determining in the future whether to give it future grants and so forth.

The point in my testimony is simply, if we create something like this, we've got to make sure the incentive structures are going in the right direction. We have relatively few dollars we can spend on it. Let's maximize the benefit of those dollars.

Mr. Valentine. To what extent is there a problem in this country that puts us at a disadvantage with the Japanese and Germans principally? That goes to the method of public education, to what we teach in the schools, to the fact that we do apparently have a lot of people in this country, it would seem to me, more than in Japan certainly, who are a part of the problem instead of part of the solution because they're not prepared to—that are not even capable of understanding sufficiently to, don't have the reading and writing skills to get a job in a factory that manufactures some of these materials. Is there the other side of the melting pot that made this country great that causes us problems?

I see row after row of Japanese people, all worshiping—looking about alike, worshiping the same god and having had the same ethnic background for hundreds and hundreds of years. That's something that we don't talk about much, I suppose. But, to what extent does that contribute to the problem?

Mr. Elkus. Can I take a shot at that?

Mr. VALENTINE. Yes.

Mr. ELKUS. Without trying to talk about the same thing that everybody else has talked about in the past, or at least that I've heard most of, although there is reading and writing problems and they are significant to be sure, if we can't develop an infrastructure of end-use markets and the concept, the understanding that these things interrelate, then the orientation of our educational system is whatever hits it next. It may come from foreign students who want to get certain key programs going in the very highest levels of education, Ph.D. status and whatever, and the bulk of those programs now support foreign students, not our own. Okay?

I can come from any number of sources. The educational program is usually in support of something. The problem that we have here, and, in fact, the problem of our dialogue, is that the orientation we have here is the art of the deal, as our friend—what's his name?—from New York would say. Okay, Trump. And with that kind of an orientation the whole concept of opportunity cost, and I don't want to keep belaboring it, but it is the primary problem. That orientation, you are ending up with an educational system that becomes eclectic. We become concerned with reading and writing, which is absolutely essential. But once you get beyond that point, what do all these people do? They will go into finance or they will go into a service industry or they will go somewhere where they think that have at least a reasonable chance of making a relatively easy dollar.

The fundamental structure of the country begins to go away. The fundamental motivation that we are competing with isn't here in our country. Without that and the source of economic funds that result from that, you can't support the kind of educational system that we want.

When you say, I want an educational system, you will define in terms of some criteria. For example, a business school. Take a business school, which is supposed to take care of our situation. What Japanese do when they send students to our business school is not to send them there to learn how to do business. They send them there to learn how the United States does business and to get intelligence on how best to compete in our markets, recognizing that they fundamentally disagree with what our business schools teach.

So what I'm trying to say is that if you don't have a fundamental concept that says everybody, every market and product gets linked, therefore if we cannot find ways of staying in those products and markets you will lose and are losing your educational system.

Mr. VALENTINE. Talking about the education system, I wasn't thinking so much about an education system that could prepare people for Harvard or some other first-rate institution. I'm talking about one that can teach people to read and write. And, I'm talking about a difference in a society, where some—what is it, 20 percent, 25 percent of the people, taking the country as a whole, I'd settle for people who could read Reader's Digest, not necessarily War and Peace. We're talking about people who can't even read the—a high percentage of the population that can't even read the phone book. And that's not true in Japan. And it does not have to be.

Mr. ELKUS. That's true. But we have a time frame on our problem, and I would like to suggest to this group here, to this committee, that by the time, and I am not in any way denigrating the effort to keep or to improve our ability to read and write in the schools...

Mr. **Valentine**. Yes. I know what you're going to say.

Mr. **Elkus**. By the time we achieve that success, the educational system will be an educational system supporting an economic environment that is directed by somebody else. And I assure you this will have effects on the educational system that go far beyond anything that we're contemplating today in ways which I'm not sure we'll find totally satisfactory.

Mr. **Valentine**. Any—Mel? Well, I would like for all of you to let us have by noon tomorrow your written solutions to all these problems, and we will implement them. No. Seriously, thank you very much for these appearances here, for the time that went into preparation, and for all that you have done to make this record here today.

Do we have anything else we need to do?

And with that the subcommittee stands adjourned.

[Whereupon, at 4:05 p.m., the subcommittee was adjourned, to reconvene subject to the call of the Chair.]

APPENDIX

Origins of RCA

Memo from Richard J. Solomon, MIT Media Lab

DURING THE VERSAILLES Peace Conference of 1919, it became apparent to Wilson and his advisors that three main areas of international infrastructure (to use the modern term) would be critical in postwar trade: energy; the merchant marine; and the very new technology of radio-communications. All three were linked in some way, most particularly the latter two. Radio (and undersea telegraphy) was dominated by the British at that time.

Assistant Secretary of the Navy Franklin Roosevelt came up with a plan for the Navy Bureau of Steam Engineering to guarantee Navy contracts to a new corporation which would endeavor to maintain an American presence in radio. This firm was organized by the General Electric Co. and bought out British holdings in the Marconi Wireless Telegraph Co. of America to form a *Radio* Corporation of America. RCA soon became a consortium to pool patents among the key U.S. players. All of this came about because:

1) Radio at the time used steam-driven, high-frequency electric alternators. GE was the major U.S. manufacturer of such equipment. Of immediate concern to the Navy Department was an offer made by British Marconi to GE to purchase exclusive rights for worldwide manufacture and distribution (including in the U.S.) of the Alexanderson alternator, which had been critical in trans-Atlantic radiotelegraphy during the War. Control of these patents by a foreign power, albeit an ally, was viewed as a risk to national security by defense interests.

2) The only generally-accepted, practical application of electromagnetic waves in 1919 was for radio-*telegraphy* in order to enhance maritime safety. The 1913 Titanic disaster had underlined this in the public mind. An international convention to regulate maritime radio traffic had been held in 1911 (a forerunner of the CCIR), with the Navy as our representative. There was little public knowledge at the time of the secret wartime experiments performed by AT&T using vacuum tubes for trans-Atlantic radio-*telephony*; indeed, conventional wisdom was that such techniques could not be perfected.

3) FDR had a close relationship with GE's management, especially its legal department.

The RCA firm started off as a wireless telegraph common carrier and patent holding company. Alexanderson was Chief Engineer while still an employee of GE. David Sarnoff, the U.S. manager of Marconi Telegraph, became RCA's General Manager.

Soon after RCA's formation, it became clear that radio technology had more in its future than just maritime communications. The problem was that three other firms held radio patents necessary for its expansion: Westinghouse (which GE was in the process of purchasing through an LBO at the time); AT&T; and United Fruit. The latter had developed radio technology to improve command and control of its vast merchant marine and plantation operations in Central America. Each participant brought something essential to the table and shares of RCA were more or less distributed among these five according to the value of their technology; the U.S. Navy held in the beginning about 20% of RCA's stock.

But things changed: within two years of the formation of RCA, commercial radio broadcasting became practical (and profitable), something not quite in RCA's original plans. The first two broadcasting stations were AT&T's WEAF in New York City, and Westinghouse's KDKA in Pittsburgh. Quite rapidly, AT&T built three separate networks of stations based on their Long Lines transmission system—the "Red" and "Blue" networks east of the Rockies, and the "Brown" network in the Pacific states. Other attempts to do the same were thwarted by lack of access to quality intercity telecommunications lines. RCA, however, began a domestic radio-telegraph service which competed with Western Union and Postal Telegraph, and threatened to compete with AT&T's private telegraph lines. (AT&T went out of its way to assure stockholders that wireless communications was really not a threat to "wireline" circuits.) AT&T's Western Electric began to manufacture radio receivers in competition with GE. And *television* research had begun in earnest (and in secrecy) at GE, Westinghouse, and Western Electric.

By 1926, RCA had been transformed by its internal contradictions from a holding company (with a telegraph department) into a manufacturing subsidiary of GE/Westinghouse. The Navy and United Fruit had bowed out. But AT&T's relationship was more complicated:

During 1925-6, AT&T and GE/RCA held a secret arbitration to settle a set of complex patent disputes. This resulted in AT&T selling its RCA stock, and an agreement that RCA would manufacture only home *receivers*, while AT&T's Western Electric would make only station *transmission* equipment. The Justice Department pressed GE to spin off RCA as a separate corporation. RCA, now under the direction of Sarnoff, purchased the Victor Phonograph Corporation to gain access to a consumer distribution system. For a nominal one dollar, AT&T sold its radio networks to the new National Broadcasting Company — a wholly-owned subsidiary of RCA. NBC agreed to use WE transmission equipment and *only* AT&T Long Lines for its network connections. GE and RCA agreed not to enter the wireline telephone business, and Congress blessed this agreement by writing its principal terms into the 1927 Radio Act (and hence the 1934 FCC Act).

Television research was transferred from Westinghouse to a new RCA laboratory under Zworikin. In turn, AT&T formed Bell Labs combining WE's labs and the Long Lines radio research department. AT&T and RCA then competed for the sound movie business, but that is another story.

While the original RCA did not work quite as its sponsors had expected, the principal goal of this government/industry consortium — strengthening the incipient U.S. electronics industry — had been met. For the next half-century the U.S. dominated world industrial, military, and consumer electronics technology. And, during the Second World War, by an order of magnitude, AT&T and RCA were the largest two military contractors on the Allied side. ■

February 7, 1989.

101st CONGRESS
2D SESSION

H. R. 4715

To provide for the formation of an industry run, Government chartered, nonprofit corporation for research, development, and manufacturing activities in the strategic high technology sector, and for other purposes.

IN THE HOUSE OF REPRESENTATIVES

MAY 2, 1990

Mr. LEVINE of California (for himself, Mr. RITTER, Mr. VALENTINE, Mr. BROWN of California, Mr. MINETA, Ms. SCHNEIDER, Mr. FAZIO, Mr. BRUCE, Mr. NAGLE, Mr. SCHEUER, Mr. WOLF, Mr. JOHNSTON of Florida, and Mrs. BENTLEY) introduced the following bill; which was referred to the Committee on Science, Space, and Technology

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A BILL

To provide for the formation of an industry run, Government chartered, nonprofit corporation for research, development, and manufacturing activities in the strategic high technology sector, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "Technology Corporation of America Act of 1990".

SEC. 2. FINDINGS.

The Congress finds that—

(1) the $70,000,000,000 federally funded research and development sector of the United States has not adequately or effectively increased the ability of our domestic industries to meet the Nation's global competitive challenges;

(2) the United States is not systematically developing the key technologies and industries that are emerging as the strategic linkages and technology drivers of the coming decades;

(3) the private sector has historically led the development of industry in the United States, and is better able to serve those functions than the public sector;

(4) a key means of revitalizing United States industry is through the promotion of our entrepreneurial base, in particular emphasizing our manufacturing and small business sectors, the primary forces driving the engine of United States economic growth;

(5) United States industry is currently at a serious disadvantage both in obtaining low-cost patient capital and in strategically coordinating resources to match the targeting efforts of our international competitors;

(6) United States industry and industry leaders have repeatedly called for an industry run group whose mission is to—

(A) catalyze the creation of consortia and joint ventures for research, development, and manufacturing in promising but potentially risky emerging technologies; and

(B) focus on long term, rather than ad hoc, solutions to the challenges to America's economically critical industries and technologies;

(7) it is in the national economic and security interests of the United States to establish an industry run, federally chartered entity called the Technology Corporation of America; and

(8) appropriations to the Technology Corporation of America should reflect a redirection of Federal research and development priorities toward technology applications and manufacturing.

SEC. 3. ESTABLISHMENT.

(a) INCORPORATION.—There is hereby established the Technology Corporation of America as a nonprofit corporation.

(b) POWERS.—The Technology Corporation of America may—

(1) establish bylaws;

(2) hire and retain consultants;

(3) hire and retain professional and clerical staff;

(4) enter into contracts;

(5) solicit and receive grants and donations in any amount from—

(A) any entity in the private sector that is eligible for assistance under section 7;

(B) any United States national; or

(C) any North American company or entity;

(6) borrow funds;

(7) purchase and own real and personal property;

(8) reimburse Federal employees or their agencies or departments for travel and subsistence and other related expenses;

(9) indemnify its directors and officers;

(10) sue and be sued; and

(11) execute such actions as are necessary to enable it to carry out its purposes and do not violate applicable law.

SEC. 4. PURPOSES OF THE CORPORATION.

The purposes of the Technology Corporation of America shall be to—

(1) assist in the redirection of Federal civilian research and development funds to better meet the strategic research and development needs of America's domestic industries;

(2) catalyze and assist in the creation of private and public sector research, development, and manufac-

turing activities focused on developing the Nation's strategic technologies;

(3) encourage cooperative research and development projects, such as consortia with industry, Government, and university participation, to bridge the gap between the Nation's laboratories and commercial exploitation; and

(4) serve as a permanent source of strategic vision for the Nation's technological and industrial base.

SEC. 5. BOARD OF DIRECTORS.

(a) MEMBERSHIP.—The Technology Corporation of America shall be governed by a board of directors consisting of—

(1) the Chairman, to be appointed by the President of the United States;

(2) 2 additional members to be appointed by the President of the United States;

(3) the chief executive officer, to be appointed by the National Academy of Engineering;

(4) 1 member to be appointed by the National Research Council;

(5) 1 member to be appointed by the President from nominations, made by the members appointed under paragraphs (1) through (4) in consultation with a

wide cross section of major industry groups, of individuals with extensive background in manufacturing;

(6) 1 member to be appointed by the President from nominations, made by the members appointed under paragraphs (1) through (4) in consultation with major organizations representing small businesses, of individuals with extensive background in manufacturing;

(7) the Director of the Advanced Technology Program; and

(8) the Director of the Defense Advanced Research Projects Agency.

(b) TIME OF APPOINTMENT.—Members described in subsection (a) (1), (2), (3), (4), (5), and (6) shall be appointed within 90 days after the date of enactment of this Act.

(c) TERMS OF OFFICE.—

(1) IN GENERAL.—The term of office of each director appointed under subsection (a) (1), (2), (3), (4), (5), and (6) shall be 4 years, except as provided in paragraph (2).

(2) EXCEPTIONS.—The term of office of—

(A) the Chairman first appointed under subsection (a)(1) and the member first appointed under subsection (a)(5) shall be two years;

(B) one of the directors first appointed under subsection (a)(2) shall be 1 year; and

(C) the director first appointed under subsection (a)(4) shall be 3 years.

(3) LIMITATION.—No individual may serve as a member of the Board of Directors appointed under subsection (a) (1), (2), (3), (4), (5), or (6) for more than 8 years.

(d) QUALIFICATIONS.—Directors described in subsection (a) (1), (2), (3), (4), (5), and (6) shall be appointed to represent a broad cross section of traditional and newly emerging United States technology industries, from among individuals—

(1) who are United States citizens;

(2) who are not employees of the Federal Government;

(3) who have a record of distinguished service in their fields; and

(4) who qualify for security clearance at the appropriate level.

(e) FINANCIAL DISCLOSURE.—Directors appointed under subsection (a) (1), (2), (3), (4), (5), and (6) shall be required to fully disclose to the Board of Directors all significant relevant financial interests.

(f) MEETINGS.—The Board of Directors shall meet at least bimonthly at the call of the Chairman, or whenever 3 directors request a meeting in writing.

SEC. 6. ADVISORY COMMITTEES.

In order to assist the Board of Directors in carrying out its duties, the Board of Directors shall establish—

(1) an advisory committee for financial issues; and

(2) an advisory committee for technical issues to assist the Board in strategic analysis, including an identification of emerging, critical, or endangered technologies and industries.

Each advisory committee shall be broadly representative of academia and industry, with membership cutting across all sectors of the economy, including representatives of small, medium, and large businesses. The Board of Directors shall, within 6 months after first convening, issue regulations governing the composition and functions of such advisory committees.

SEC. 7. ASSISTANCE.

(a) ELIGIBLE RECIPIENTS.—

(1) GENERAL RULE.—The Technology Corporation of America may provide assistance only for projects—

(A) where majority control is held by North American companies or entities, except as provided in paragraph (2); and

(B) that demonstrate to the satisfaction of the Board of Directors the ability to obtain funding equal to or greater than the funding requested from the Technology Corporation of America.

(2) FOREIGN COMPANIES OR ENTITIES.—No foreign company or entity may receive assistance from the Technology Corporation of America, or participate in a project receiving assistance from the Technology Corporation of America, unless the Board of Directors determines that participation by that company or entity—

(A) uniquely promotes the purposes of the Technology Corporation of America;

(B) satisfies reasonable criteria of international reciprocity; and

(C) has provided substantial investment in the United States and employment to United States citizens in the United States, including research and development, engineering, and key management positions.

(b) SELECTION CRITERIA.—In selecting projects for assistance, the Technology Corporation of America shall—

(1) subject proposals to merit review;

(2) encourage, where appropriate, the participation of small United States businesses; and

(3) apply such other criteria as the Board of Directors considers appropriate.

SEC. 8. OWNERSHIP OF TECHNOLOGY RIGHTS.

(a) General Rule.—Except as otherwise provided in this section, property and licensing rights to technologies developed by a project receiving assistance from the Technology Corporation of America shall be allocated by agreement among the project participants and the Technology Corporation of America.

(b) Technology Sharing With Foreign Companies or Entities.—No company or entity participating in a project receiving financial assistance from the Technology Corporation of America may license or in any other way share technology developed by such project with a foreign company or entity not participating in that project without permission from the Technology Corporation of America.

(c) Technology Corporation of America.—The Technology Corporation of America is entitled to license technology developed with its financial assistance to the United States Government for its internal use without payment.

SEC. 9. OVERSIGHT.

(a) ANNUAL REPORT.—The Technology Corporation of America shall annually submit a report to the Congress and the President which shall contain—

(1) a description of its activities undertaken during the preceding year;

(2) an assessment of its success in accomplishing its goals during the preceding year;

(3) a statement of its goals for the upcoming year; and

(4) an audit of the corporation performed by a reputable accounting firm.

(b) COMPTROLLER GENERAL REVIEW.—The Comptroller General of the United States shall review the audit submitted under subsection (a)(4) and submit to the President and the Congress an assessment of the accuracy and completeness of such audit, along with any additional comments the Comptroller General considers appropriate.

SEC. 10. NONFEDERAL STATUS.

The Technology Corporation of America shall not be considered an agency or instrumentality of the United States Government.

SEC. 11. ALTERNATIVE ASSISTANCE OPTIONS REPORT.

The Office of Technology Assessment, in consultation with the General Accounting Office, shall, within one year after the date of enactment of this Act, submit to the Congress and the President a report detailing the range of alternative traditional and innovative assistance options that could be available to the Technology Corporation of America, along with an assessment of the desirability of each such option.

SEC. 12. DEFINITIONS.

For purposes of this Act—

(1) the term "foreign company or entity" means any company or entity not described in paragraph (2); and

(2) the term "North American company or entity" means any company or other entity in which majority beneficial ownership or control is held by individuals who are citizens of the United States or Canada, except that such term includes a company or entity substantially owned or controlled by Canadian citizens only if, in the judgment of the Secretary of Commerce, the company or entity is not acting, with respect to a project receiving financial support under this Act, as an agent or intermediary for a third country company, entity, or government.

SEC. 13. AUTHORIZATION OF APPROPRIATIONS.

There are authorized to be appropriated to the Secretary of Commerce for the benefit of the Technology Corporation of America, for carrying out this Act, $50,000,000 for each of the fiscal years 1991, 1992, and 1993. Funds authorized under this section shall be derived from otherwise authorized Federal civilian research and development authorizations.

THE NEED FOR A CIVILIAN ARPA

A Statement by

Dr. Burton I. Edelson

Fellow

Johns Hopkins Foreign Policy Institute

Washington, DC

before the

Committee on Governmental Affairs

U.S. Senate

June 12, 1990

THE NEED FOR A CIVILIAN ARPA

Burton I. Edelson

I am pleased to appear before you this morning to participate in this hearing on the proposed Trade and Technology Promotion Act, S.1978, a bill which includes provisions to create an Advanced Civilian Technology Agency (ACTA). I would like to speak in favor of an ACTA to the extent that it shows promise of becoming a civilian counterpart to the Defense Advanced Research Projects Agency (DARPA).

I am currently a Fellow at the Foreign Policy Institute of the Johns Hopkins University and a Research Professor in Electrical Engineering and Computer Science at George Washington University. From 1982 to 1987, I was Associate Administrator for Space Science and Applications of NASA responsible for directing a $1.5 billion per year R&D program and two major research centers--the Goddard Space Flight Center and the Jet Propulsion Laboratory. At NASA, I was deeply involved in the development and use of high technology. I participated in international cooperative programs which allowed me to note technological progress in other countries. I was in a position to observe U.S. government-sponsored research at many levels. I observed both the compartmentalization and the transfer of technology in various agencies, and I became concerned about the lack of progress and diminishing world leadership of the United States in many technical areas. During my time at NASA, I also worked closely with and co-sponsored research at DARPA. I grew to have great respect for that organization, its accomplishments, and its continuing sets of contributions to the U.S. technology base.

Even more directly connected with the focus of my testimony today, over the past year, I directed a project at the Johns Hopkins Foreign Policy Institute on "Issues in Technological Competitiveness." This project received financial support from the Carnegie Commission on Science, Technology and Government. The project involved a study of the effectiveness of DARPA and its applicability to the civilian needs of the country. A report has been issued[1] and is available to this Committee. I ask that it be made part of the record.

The objectives of that study were to review the origin, goals and achievements of DARPA and to assess its effectiveness in serving the needs of the DOD in developing advanced technologies and systems. We also reviewed how DARPA's organization, procedures and style of operation, and the scope, depth, and orientation of its programs contributed to the agency's output over its thirty-year history. We paid particular attention to the operating methods that DARPA employed, and the degree to which the agency was successful, in: (1) identifying new, promising technological areas, (2) enabling the pursuit of unusual or risky technologies, and (3) in transferring new technologies to military users and the defense industrial base.

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[1] Burton I. Edelson and Robert L. Stern, "The Operations of DARPA and its Utility as a Model for a Civilian ARPA", Johns Hopkins Foreign Policy Institute, Washington, DC, November 1989.

Further, in our study, we attempted to evaluate how the role of DARPA might be strengthened and/or broadened to meet national needs in the development of technologies for use in the civilian sector. We considered three possible courses of action: (1) extending DARPA's charter to cover civilian technologies; (2) elevating DARPA to a national level ("NARPA"); and (3) creating a civilian counterpart to DARPA.

We conducted interviews with some fifty individuals who have had experience with DARPA and who would be in a position to provide judgement on the merits and liabilities that might be connected with expanded roles for DARPA. Those contacted include the director and numerous program managers of DARPA, several former DARPA directors, officials in DOD and other government agencies (e.g. Commerce, NSF, NASA, DOE), contractors to DARPA, industrial R&D executives, CEOs, members of Congress and their staff, and representatives of the national academies and other organizations that have concern for U.S. industrial competitiveness.

In the course of our study we came to appreciate what kind of an organization DARPA really is and how it works within the DOD. Today's DARPA, with a 1989 budget of $1.3 billion, is an integral part of DOD's overall $40 billion R&D effort--all within DOD's total annual outlays of nearly $300 billion. About 7% of DARPA's budget is devoted to basic research, about half (47%) to exploratory development, and slightly more than 40% to advanced development.

In its thirty-year history, DARPA has played many special roles in supporting DOD's scientific and technological effort. DARPA has become a small but hard-hitting agency, integrated with the mission of a much larger one. DARPA's success rate can be accounted for to a substantial extent by its ability to pick its targets with wide-ranging knowledge of what its principal customer, DOD, has needed.

Thus, DARPA is not a free-standing, disembodied or independent agency for technology and systems development. On the contrary, DARPA coordinates its projects--research, technology development, prototyping, program operations, etc.--closely with potential users in DOD. DARPA has had no in-house laboratories, and, executes most of its contracting via offices in the military services, thereby creating a path right from the beginning for technology transfer to the potential user.

The general conclusions of our report are that (1) DARPA has been extremely effective over the years in identifying and stimulating the development of military-related technologies; and (2) that a civilian counterpart to DARPA would be very valuable in promoting the development of technologies which are critically needed by, or potentially of great value to, U.S. civilian industry. We noted in our report that in many respects the civilian ARPA should operate in a manner similar to the military-oriented DARPA, but, to be effective, it must be quite different from DARPA in several other major respects.

According to our report, a model civilian ARPA should have the following attributes:

Organization - The civilian ARPA should be placed high in the government hierarchy, in a position of visibility with strong support by the Administration. The agency should have an annual budget of $300 to $500 million. It should perform work in six to eight technical fields and have twenty to thirty major projects.

Personnel - The civilian ARPA should have an outstanding, widely recognized engineer or scientist as its director. It should have absolutely top quality program and project managers, serving tours of three to five years.

Procedures - The civilian ARPA needs a great deal of flexibility in its operations. It should not be limited to conventional government procurement (buyer-seller) procedures. Rather, it should be allowed to enter into cooperative arrangements of many types involving investment and shared facilities. It should participate in investment, research and development consortia, and cooperative and cost-shared ventures. It should have authority to do business with industrial and non-profit corporations, universities, government laboratories, and federally funded research centers.

Style - The civilian ARPA should be alert, aggressive, and informal. The staff of the agency should be visible and available. Staff members should travel extensively and attend more scientific conferences than budget reviews. They should seek out innovative researchers, revolutionary technical findings and approaches, and not wait for proposals to land on their desks. In short, the agency should be pro-active.

Not surprisingly, at least to those acquainted with the successes of DARPA, there was general agreement that the attributes above would contribute to the success of a civilian ARPA. Two additional debatable issues arise:

* Where should the civilian ARPA be located organizationally; and

* To what extent should a mix of government and non-government people and funds be used to staff and support the civilian ARPA?

In our study, we addressed those issues, listed pros and cons, and like most studies recommended further study. However, I will now give my personal opinion on these issues. Before I do so, however, I would like to remark on the need for prompt action.

I just returned from a three week trip to Japan during which I visited research laboratories and factories, talked with government and industrial executives, and saw demonstrations of advanced space, telecommunications, and computing equipment. That visit reinforced my belief that the United States is behind, and falling further back all the time, in a number of technologies. I am convinced that this country must take strong positive measures to reverse this negative trend in our technology development. It is apparent that our private sector alone cannot or will not cooperate and invest adequately to advance technologies on a broad front. Only the Government, I believe, can promote, and if necessary force those advances. This does not mean that the government should do it all, or bear the burden of paying for it alone. Quite the contrary, unless the private sector, primarily industry, participates in the management and funding of the needed technological effort, the civilian ARPA simply won't work. A civilian ARPA should, I suggest, be structured along the following lines to do the job.

The civilian ARPA should be located in the Department of Commerce.

An alternative, previously considered, was to make DARPA a national agency ("NARPA"), to broaden its role to encompass responsibility for developing civilian technologies. This would have the advantage of building on a proven capability, but, as we noted in our study, this move might weaken DARPA's national security contributions. However, since the study was completed, events have demonstrated, and my own inclination leads me to believe, that the DOD cannot even-handedly manage research and technology development for the civilian sector. Military, or military-political considerations, would always be paramount. Thus, in my opinion, DARPA should be left alone to continue its excellent work in developing military technology and systems, and a new agency, a truly "civilian ARPA" should be created outside of the Defense Department.

For the same reasons that the civilian ARPA should not be part of DOD, it should not be combined with any other program-oriented agency such as NASA or the Department of Energy, nor should it be placed in NSF, a research organization.

I am convinced that the place to put the civilian ARPA is in the department whose mainline responsibility is to promote American technological competitiveness, industry and trade--the Department of Commerce (whether or not it acquires a new name as proposed in S.1978).

Within the Commerce Department, the relation of the civilian ARPA to the existing National Institute of Standards and Technology (NIST) and its Advanced Technology Program (ATP), should be addressed. DARPA, has been successful in identifying and stimulating technology development over the past few years without benefit of its own laboratories. In fact, some of its success has been attributed to the freedom and flexibility that DARPA has been able to exercise by not having to bear the burden of supporting in-house facilities. An executive order, in fact, now prohibits DARPA from having its own labs. Following that reasoning, I would suggest not combining the two organizations at Commerce, but rather placing the civilian ARPA in parallel with NIST, both reporting to the Under Secretary for Technology.

NIST, as an organization and a facility, should, in my opinion, remain undisturbed and be encouraged to continue on its present fruitful course. The ATP is a new, relatively small research program of NIST intended as an outreach to industry. ATP's new authority and role is of great importance. It should remain within NIST and should grow significantly in size and scope. Someday, perhaps, after the civilian ARPA has come into being, cooperation between it, NIST, and the ATP could flourish--as it now does between DARPA and various other government research organizations and programs.

The civilian ARPA should be a joint government-industry enterprise.

In the 45 years since the end of World War II, a compact has been forged between "American science" and the federal government; it resulted in the acceptance of tax-supported appropriations for the operation of a $2 billion National Science Foundation and a $7.5 billion National Institutes of Health, aimed at the conduct of basic and applied research, primarily at universities.

No similar agreement has been reached for the application of federal funds to support technology-based industrial development --except to the extent that federal RDT&E funding for national security purposes offers derivative benefits to the broader-gauge and more diversified civilian economy.

Since the role of the federal government in funding the development of technologies for utilization in civilian applications has not been accepted, any proposed plan for a civilian ARPA also still needs to obtain the political and financial support of industry. One way to obtain this would be to establish a civilian technology agency outside of the government framework and bring industry into that endeavor as a partner. This would allow the private sector to participate in the staffing of the agency and funding of its programs.

The civilian ARPA needs top flight engineers and scientists to fill its executive positions and staff its program offices. The agency should be able to recruit its personnel from industry or academia as well as from government, and its people should be able to return to their former pursuits after leaving the agency. In order to attract the necessary talent, the agency will require significant relief from civil service restrictions; better yet, it might be organized outside of the Civil Service system, perhaps as a government corporation.

Funding for the civilian ARPA and its programs should be shared between government and industry. No overall ratio would suit all intended functions and activities of the agency. My own suggestion would be that all personnel and administrative costs of the agency be borne by the government. Program costs should be shared in proportion to readiness and relevance. This would mean that basic research might be largely government supported. Applied research, say work in solid state physics expected to lead to advanced semiconductors, for example, might be split 50/50 between government and industry. Development of a telecommunications system, a supercomputer network, for example, might involve 80% funding by industry. It is important here to note that government's role is more than contributing money--in the civilian ARPA the government would contribute technological leadership and expertise and influence--all important ingredients in a program of advanced technology development.

Creating a conceptual design for a civilian ARPA, crafting the legislation needed to enable it, and gaining consensus of the disparate forces of government and industry needed to implement it are very difficult tasks. But the need is urgent and worth the effort.

I believe that ACTA, as proposed in S.1978, is well conceived and properly aimed. I would suggest modifying the description of ACTA in that bill to match the attributes of a civilian ARPA as I have sketched it out above, but I commend the authors of the legislation, its sponsors, and this Committee for its work on this matter of such extreme importance to the technological health of our nation.

I stand prepared to respond to your questions and thank you for allowing me the opportunity to bring forward my views as part of an important debate.

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